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CHAIN MAKING MACHINE.

Chain cable for anchors is generally made by hand, each link being separately welded by the hammer of the blacksmith. When it is considered that on the perfection of each weld the safety of a ship, with all her cargo and the lives of passengers and crew, depends the necessity of a reliable chain is evident.

The cable produced by the machine represented in our engraving is of one and a quarter inch iron, of superior excellence in appearance as well as in quality. The links are perfect in form, the weld is invisible, and the strength of the chain has, as is stated, been proved by actual test to be much greater than that of the best handmade. The standard test for cable formed from one and a quarter inch iron is twenty-eight tuns; but chain of this size, made by the machine, withstood a strain gradually increased to forty-six and a half tuns before breaking. Even then the fracture occurred not in the weld but in the opposite end of the link, thus proving the welding to be equal in strength with the iron used.

The illustration shows the position of the chain in the machine while being manufactured. The anvil block is a cubical mass of iron having a square recess from top to bottom, in which fits a vise or die carrier. This is pivoted at the bottom, and is operated by toggle jointed levers. This joint is connected to the vise at the top and to a crosshead or horizontal beam at the other end, and is elevated and depressed by the piston of a small steam cylinder standing upright directly under the union of the levers. Inserted in the face of the vise is a die, cut to receive the half of one link in a vertical and the half of another in a horizontal position. A corresponding fixed half in the anvil completes the die. When closed the latter presents on its face two holes, as far apart as the width of the link, and of a size to receive the iron to be welded. There is a channel passing between these holes for the reception of the last welded link. A trough or leader, inclined and leading from the back of the machine, through a slot in the center of the die, serves to convey the studs or bridges, and by a simple automatic movement, a single one is fed to the die simultaneously with the closing of the vise.

The small cylinder, with its piston rod attached to the upper side of the toggle joint, is filled with water, and serves only to steady the movement of opening and closing the vise.

Rising from the back of the anvil block is a heavy frame, supporting above a steam cylinder of thirteen inches diameter with a square piston rod, which serves as a hammer or press, the end of which is formed to correspond with the channel in the top of the die, and recessed to receive the link to be welded.

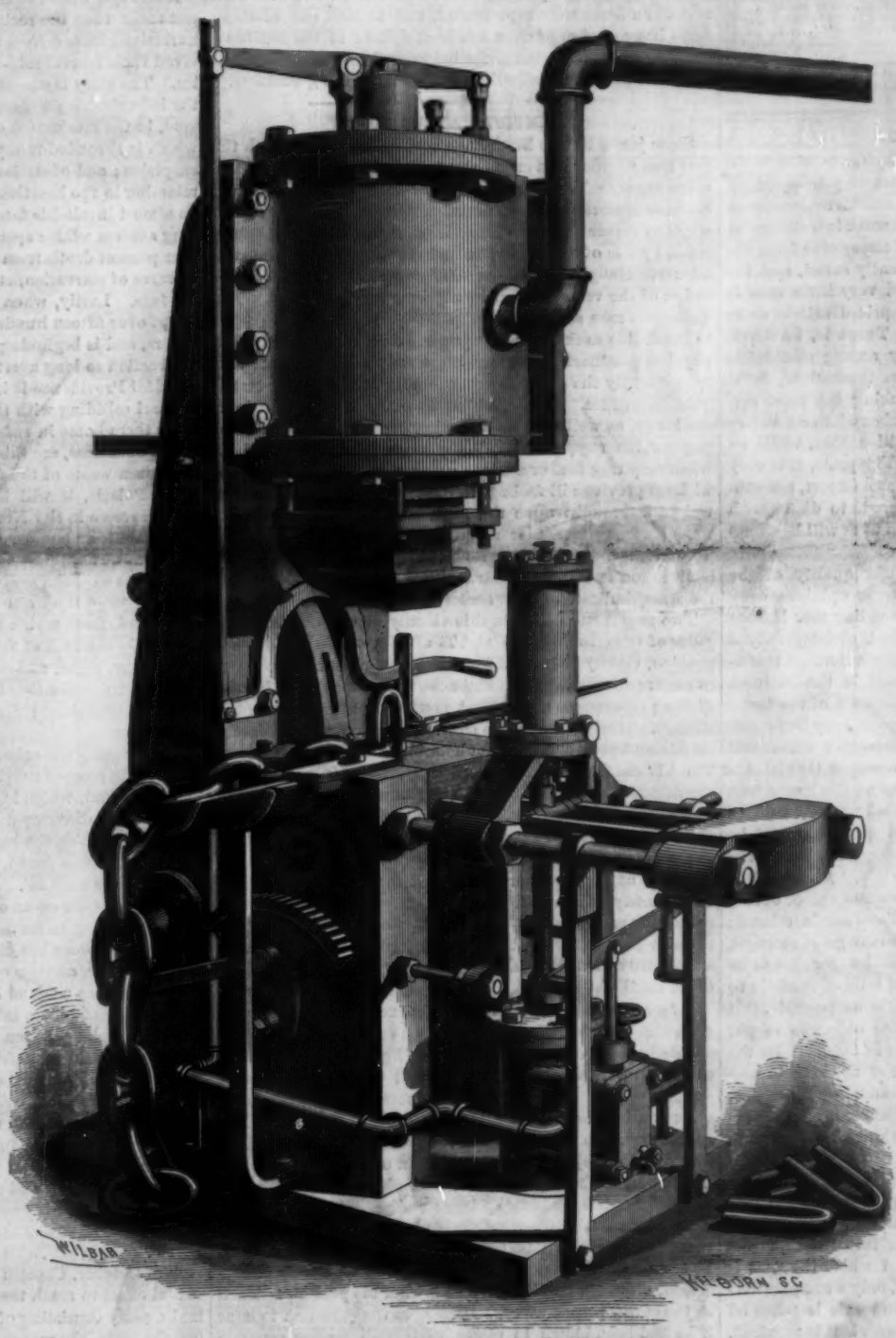
There is another attachment, not shown in the engraving, a description of which is unnecessary, as it is merely an automatic appendage designed to turn and move the chain along as it is completed; when attached it is operated by the segmental gear shown on the side of the anvil block.

The links are prepared by another machine, which cuts and bends them to the form of an elongated U.

The operation of the machine is as follows: Convenient to the machine is a furnace, provided with more or less openings to receive the ends of the links, which, when properly heated, are inserted into the apertures of the closed die. Steam is then admitted, and the hammer is brought down, thus forcing, with a single blow, the link into the die and bringing the ends together, forming a butt weld. The vise is then opened by the small cylinder below, and the perfectly formed link extracted. The vise is now closed, and the last made link placed in the channel between the apertures of the closed die, when the next link is similarly proceeded with.

Links for connecting railroad cars, and those for bridges and many other purposes, can be made with this machine, with a slight alteration. One of the merits of the apparatus is the perfection of its weld, it being instantaneous and affecting the whole surface of the uniting parts at once.

The inventor claims that this is the first successful attempt to weld chain cables by mechanism, and the importance of the product is such as to give to his invention the interest and value due to a much needed industrial improvement. Patented by William Dennison. For further information address H. B. Dennison, East Cambridge, Mass., where the machine can be seen in operation.



MACHINE FOR MAKING CHAIN CABLES.

An Expensive Motor.

The *English Mechanic* says that a small motor, suitable for sewing machines, has been invented by Friedrich Siemens, in Dresden. It is described as a steam engine which has neither cylinder, nor piston, nor guide bars, nor crank, nor valves, but only a boiler, which is at the same time the moving part. The machine works always with one and the same quantity of water. The steam passes through a cycle something like what is seen in nature; the sun evaporates water on the earth's surface; in the upper strata this again becomes liquid, and returning to the earth does a large amount of mechanical work. The machine is only 0·1 horse power, needs little alteration, and is quite safe, the tension of the steam being low. If heated by gas, it consumes 2·5 cubic meters per hour. The cylinder-shaped boiler is expanded conically at the upper part. It stands at an angle of 45°, and turns on supports, while a beveled wheel arbor changes the motion into a horisontal or a vertical. It will be seen in action at the Vienna Exhibition. The above description is as clear as mud.

Tumbling Pigeons.

Professor Darwin, in a recent communication in *Nature* upon the origin of certain instincts, referring to tumbling pigeons, says:

The behavior of the ground tumbler or lotan, of India, renders it highly probable that in this sub-breed the tumbling is due to some affection of the brain, which has been transmitted from before the year 1600 to the present day. It is neccessary gently to shake these birds or, in the case of the Kalmi lotan, to touch them on the neck with a wand, in order to make them begin rolling over backwards on the ground. This they continue to do with extraordinary rapidity, until they are utterly exhausted, or even, as some say, until they die, unless they are taken up, held in the hands, and soothed, and then they recover. It is well known that certain lesions of the brain, or internal parasites, cause animals to turn incessantly round, either to the right or left, sometimes accompanied by a backward movement; and I have just read, through the kindness of Dr. Brunton, the account given by Mr. W. J. Moore (*Indian Medical Gazette*, January and February, 1873) of the somewhat analogous result which followed from pricking the base of the brain of a pigeon with a needle. Birds thus treated roll over backwards in convulsions, in exactly the same manner as do the ground tumblers; and the same effect is produced by giving them hydrocyanic acid with strychnin. One pigeon which had its brain thus pricked recovered perfectly, but continued ever afterwards to perform summersaults like a tumbler, though not belonging to any tumbling breed. The movement appears to be of the nature of a recurrent spasm or convulsion, which throws the bird backwards, as in tetanus; it then recovers its balance, and is again thrown backwards. Whether this tendency originated from some accidental injury, or, as seems more probable, from some morbid affection of the brain, cannot be told; but at the present time the affection can hardly be called morbid in the case of common tumblers, as these birds are perfectly healthy and seem to enjoy performing their feats, or, as an old writer expresses it, "showing like footballs in the air." The habit, apparently, can be controlled to a certain extent by the will. But what more particularly concerns us is that it is strictly inherited. Young birds reared in an aviary which have never seen a pigeon tumble, take to it when first let free. The habit also varies much in degree in different individuals and in different sub-breeds; and it can be greatly augmented by continued selection, as is seen in the house tumblers, which can hardly rise more than a foot or two above the ground without going head over heels in the air.

HORSE CHESTNUT STARCH.—Starch is now manufactured in the south of France and the neighborhood of Paris from the horse chestnut. This nut yields about 16 or 17 per cent of pure starch. If it is to be used as food, it must be treated with water containing carbonate of soda, to remove all the bitterness, and then the starch must be washed repeatedly with pure water.

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LEATHER BELTING.

Good bands, well put on pulleys of sufficient size to do easily the work required, constitute no small proportion of the expense of getting into operation any considerable amount of machinery; but when this part of the work is well done at the outset, an almost endless amount of annoyance from the breaking down of machinery is subsequently saved, and the good belting, if properly cared for (and very little care is needed), will so long outwear the low priced article as to make it cost really far less in the end. There is, however, considerable misapprehension, not only among machinists but even among belting manufacturers themselves, as to what constitutes the best leather for making the most serviceable bands, and, with the large number of firms in the business, there is such an active competition that, while an apparently good belt can be bought at a low price, it is very difficult, and almost impossible, even for an expert, not considering where the belt was manufactured, to distinguish between the best belts and those which in wear will be found decidedly inferior.

The first point to look at in a belt is the quality of the leather, and here we have at once diverse opinions even among belting manufacturers, some contending that leather cannot be made too heavy and too hard for the best quality of belts. This is the general impression among foreign manufacturers, and the same idea is advanced in the business here, but it must be evident, on an examination of the facts, that such an opinion is erroneous. There is very little difference in the texture and appearance of leather which will wear best for the soles of boots and shoes and that which will serve best for band leather, and most of the heavy harness leather, if well stretched and finished with less oil or stuffing, would make good belt leather. But it should be noted that, in the best belt leather, the original fiber of the hide must be as little disturbed as possible. An examination with a microscope of the edge of an ordinary piece of sole or belting leather will show how these fibers are interlaced; and, when not disturbed, this constitutes the great strength of a raw hide. The object in tanning belt leather should be to unite the tannin and the gelatin in the cells of the hide so as to preserve, while disturbing as little as possible, this tissue of fibrin, while for sole leather the object is to put into the hide the largest possible amount of tannin. By the first method the original tensile strength of the hide is preserved and added to; and by the second, where tensile strength is not so much the object, the leather is made harder and tougher to stand the wear in the way of attrition to which it is to be subjected.

Notwithstanding, however, the necessary distinction here made, it is very difficult to mark the point between the best belt and the best sole leather, taking only a small piece of each; but another point, of far greater importance, is the proper selection of the part of the hide of which the belt is made. For the making of the best belts, only a comparatively small portion of a hide can be used, and this is taken off the butt or thickest part. Where a cheaper belt is required, a larger portion of the hide is used, covering a portion where wrinkles exist, or an unevenness of service. These defects may be in a great measure covered up by rolling and stretching, but the natural shape of the hide will soon make itself manifest, so that the belts will not hug the pulleys closely and will run unevenly. It is understood that the largest and best hides are always selected for belt leather, and that they must be free from cuts or brands; but where this is not the case, the purchaser can readily see that he is buying a low-cost article.

It is a great desideratum to have the belt hug the pulley as closely as possible, and this is best attained by running what is called the grain or hair side next the pulley, with the flesh side out, and for this purpose all good belt leather is most thoroughly dried and rolled very hard, to change as little as possible in use and present a smooth, even surface to the pulley. Where a thick belt is used, there is an advantage also in having the flesh side out, from the fact that it gives and stretches more readily, as it has not the firm even surface of the grain side. It is now coming to be understood, however, that pulleys covered with leather, will add greatly to the efficiency of a belt, and that a much larger amount of work can in this way be done without the slipping of the belt. If the band hugs the pulley the more closely, as it does with the latter covered with leather, it will not need to be strained so tightly, and will, therefore, wear proportionately longer, although this is of small account compared with the large saving of power which would thus be effected. There is good reason to believe that, in many establishments where the power is not sufficient, this simple improvement alone, which costs very little, would supply just the deficiency.

To keep belts soft and pliable, but little care is generally needed, but a little attention on this point would be well worth the while of many mill owners. When a belt is dry and husky, but still pliable, a little blood-warm tallow dried in by the fire or the heat of the sun is all that is needed. Belts which have become hard and dry should have an application of neats' foot oil mixed with a small quantity of resin.

One not acquainted with the business cannot fail to be surprised at its extent. A convention of belting manufacturers was held in New York city a few months since, for the purpose of agreeing upon a general tariff of prices, at which seventeen firms were represented, and at least one of these firms has a capital of over a million dollars in the business, running seven large tanneries in Pennsylvania and Maryland to make leather, principally used in their belting business.

SCIENTIFIC EXECUTIONS.

Since juries in this State have become impressed with the fact that murder is a crime punishable by death, and not a mere vagary of an "emotional" or other form of insanity, we have remarked some comment relative to the question why the present barbarous mode of execution is not superseded by one of the ready methods of taking life known to science. Hanging by the neck is supposed to cause a dislocation of the vertebræ, but its object is rarely effected. The distance a man should be dropped or jerked upward in order to break his neck depends upon his size, weight, and other physical peculiarities, so that it can only be guessed at; and consequently the estimate is frequently incorrect and strangulation ensues. It is asserted by many that death from the latter, as well as from any other cause involving a stoppage of the supply of air to the lungs, is painless; and, as when respiring foul or noxious gases insensibility supervenes without previous ill feeling, so the criminal, the moment his weight is brought upon the rope, becomes unconscious, although strong muscular movement may continue. This, however, is a disputed question, and the majority of opinion inclines to the belief that strangulation is attended with all the agony indicated by the contorted features of the sufferer.

Two recent executions in this vicinity, at one of which the pulse of the criminal beat at 108 after five minutes of suspension, clearly show that no matter how great care be taken to ensure speedy death, an absence of suffering due to failure of the preparations at the last moment cannot be guarded against. Hence it is well to consider why a death absolutely certain and painless could not be substituted for the gallows. The advocates of hanging point to its horrible nature, and the degradation of being strung up like a dog in the presence of witnesses, as a moral preventive of crime; but it is doubtful whether a person disposed to murder ever gives a thought to the nature of the penalty, or, even after imprisonment, shudders at aught other than the unknown pangs of death. Of the many mechanical means of execution proposed and practised, probably the surest and most bloodless is the Spanish garotte, but in this, as in hanging, there is a savor of barbarity of which a civilized community can well afford to rid itself.

It seems to us that, for the purpose, no better agent than a powerful electrical discharge could be employed. Professor Tyndall has investigated the effect of lightning strokes upon the human frame, and has arrived at the conclusion that animation and consciousness are instantly suspended; in other words, life is blotted out the moment the current passes through the body. The Professor involuntarily made himself the subject of an experiment of this kind, though fortunately without harmful results. He states that, while delivering a lecture before a large audience, he accidentally came in contact with a wire, from which he received the discharge of a powerful battery of Leyden jars. For a time, he says, his existence was suspended; he was utterly unconscious, although he did not fall nor alter his position. Then as the effects passed away, he describes the sensation to be as if he had been blown in pieces, each limb feeling separate and one member after another regaining sensitiveness until he had entirely recovered. The recognition of his surroundings, suggesting where he was, and also the thought of not alarming his audience were his first efforts of mental consciousness.

While these experiences of Professor Tyndall go to show the instantaneous and deadly effect of large quantities of electricity upon the human frame, other investigations that have been made upon the lower animals have given different and varying results. Professor Pepper, in one of his lectures in this city, stated that at one time experiments were made in London in order to determine whether cattle could not be slaughtered by this means. It was found that sheep, after receiving a discharge, underwent powerful muscular contortions which engendered a strong doubt as to whether sensation were absent. Pigeons were very difficult to kill, and, indeed, the only bird which appeared instantly affected by the shock was the common turkey. These facts may be explained by the non-conducting qualities of the wool of the sheep and the feathers of the birds, and in addition the inference may be fairly drawn that such experiments made upon animals afford no data which may with certainty be considered as applicable to man.

The objection that electrical executions would be free from the horrible impressiveness of hangings might be easily obviated. The criminal, for instance, could be exposed upon a platform, in full view of the assembled witnesses, and manacled to a chair, his irons being connected with a battery and Ruhmkorff coil capable of giving, say, an 18 inch spark. The mode of closing the circuit might be a simple button to be pressed by the finger of the sheriff. Then when the usual formalities conclude, the latter official establishes the current, the convict instantly expires, and all is over. There would be no slipping nor breaking of ropes, no black cap, no suspension of a writhing form for twenty minutes or half an hour, none of the grim watching for death by the medical attendants nor any of those hideous surroundings which now only serve as food for sensation mongers, and prove that a relic of barbarism can still be retained in the laws of a civilized country.

THE LATEST ARCTIC EXPLORATIONS.—THE REMARKABLE ESCAPE OF THE POLARIS PARTY.

A strange, eventful history, more like the fiction of the romancer than the recital of plain unvarnished fact, is the narrative gleaned from the lips of the men who have survived their fearful mid-winter voyage on a raft of floating ice. The story is one of hope and bitter disappointment; of the indomitable perseverance of an intrepid leader toward a goal, in the attainment of which he was prevented by a death which is shrouded in mystery, and not untouched with dark suspicion; and of strife and dissension among the crew, culminating in the heartless abandonment of a score of souls to an almost inevitable fate. Then follows the record of the long sunless winter spent on the ice floe, the horrors of an ever present death from the fury of the waves, or the slower tortures of starvation, staring the despairing band hourly in the face. Lastly, when the perilous craft has, after being swept over fifteen hundred miles of ocean, reached warmer waters, and is beginning to melt gradually away, when the destruction so long averted seems imminent, the finger of a merciful Providence is interposed, and by wondrous fatality a vessel colliding with their floe rescues the wanderers and bears them home in safety, snatching them from a doom which doubtless, ere this, has overtaken their comrades in the frozen waste of the far North.

The Polaris, it will be remembered, was fitted out for Arctic service in the New York navy yard, during the summer of 1871, and under the immediate supervision of her commander, Captain Charles F. Hall. Leaving the port she touched at St. John's, Newfoundland, and in the early part of August met the United States steamer Congress, at Disco, Greenland, from which vessel she received her final supplies. On the 24th of the month, after purchasing Esquimaux dogs, skins, and other necessaries, Captain Hall wrote his adieu to civilization from Tessinsack; and from that date to the present time, no tidings of the expedition have been received.

After leaving Greenland, the ship, according to the statement of the rescued survivors, proceeded to the north through Smith's Sound, which is described as identical with the Polar Sea of Kane, discovered in 1853–5, and reached Robeson's channel, in which the highest latitude was attained, 82° 16′. The strait, it was found, extended north for about 45 miles, from 81° 44′ to 82° 20′. Beyond this was a lead of water, and then another ocean or bay, having on its western side land stretching as far as the eye could reach, and on the east another shore but dimly discernible. This expanse was free from ice, and is conjectured to be either the North Polar Ocean, or a sound leading directly thereto. Many important circumstances indicated with great clearness that beyond this channel lay an open sea, for mild weather, fogs and mists, could come from no other source. There was no impediment to immediate advancement, and every probability existed of a clear path directly to the long sought pole. Buddington, the sailing master, became anxious, and strongly opposed proceeding further, grossly, it is stated, misrepresenting the difficulties and dangers of such a course. He being the navigator and the official judge of this expediency, Hall, contrary to his own inclinations and those of others of his crew, yielded, and returned to winter at Polaris Bay, lat. 81° 38′, long. 61° 44′, where the ship was soon frozen in. On the 10th of October, Captain Hall determined to make an individual effort to reach the polar sea, and accordingly organized a party consisting of himself, two Esquimaux and Chester, the mate, the means of transportation being dog sledges. After an absence of two weeks, on the 24th of October the expedition returned, but as to what it accomplished no authentic information can be gathered. Hall on his arrival was in good health, but soon complained of the heat of the vessel. A cup of coffee was given him, after which he became quite ill. From the statements of Joe, the Esquimaux, it seems that he believed that he was poisoned; and he said so, pointing out to his attendant the name of a drug, which the latter cannot remember, in a medical work. Added to this, there is a strange reticence on the subject among the white men saved, although it is hoped that later they may impart fuller particulars. After fifteen days the captain died, as it is stated, of apoplexy, though it is very difficult to reconcile the quick stroke of that disease with the symptoms of

vomiting, paralysis, etc., described. He was buried during the dark winter's day by the light of a solitary lantern, in a grave hewn in the ice—sleeping in the midst of the solitude, the secrets of which he had given his life in seeking to reveal.

Afterwards the weather became somewhat warmer, ranging from zero to 15° below. The wind was at times very strong, often blowing at the rate of 60 miles an hour, and the fog and mists continued. During June, Mr. Tyson set out with two boats, but was soon obliged to return. The vessel now became very leaky, and finally Buddington abandoned the expedition and started homeward. On the 15th of October, in lat. 80° 02′, the ship encountered severe gales and became jammed among the bergs, the ice lifting her out of water and crushing her badly. Anticipating her breaking away, orders were given to shift the provisions ashore, but after the greater part were deposited, together with a number of rifles with ammunition, a heavy storm arose, which caused the ship to part her moorings. The crew on the ice signaled and shouted for assistance, but although the vessel was under control and could have returned to their succor, no effort was made to do so, and the abandoned men saw with despair their apparently only hope of safety disappear in the darkness. The next day Mr. Tyson, who was among the number, attempted to reach land in the boats, but was unable to do so. Soon after the Polaris hove in sight under canvas and steam, making her way along the shore. The men tried every means to attract attention, but, although the ship was but eight or nine miles away and her crew must have seen the signals, she kept on her course and dropped anchor in a bay on Northumberland Island. Again the boats were launched, and again a struggle was made to escape from the floe, but the water was thick with ice and the drift and snow too powerful to overcome. Then the ice raft commenced the voyage, which lasted until the 30th of April last, or 197 days. Up to the 1st of November the narrative tells of repeated attempts to reach the shore, and of as many failures; then land disappeared and the weather became stormy, the men relinquished their endeavors, and built snow houses on the pack to protect themselves. Three were dwelling houses and one was for stores. The party now consisted of Captain Tyson, Joe, Hannah (his wife) and one child, Hans Christian, wife and four children, and Mr. Myers and eight men. On the 1st of December the Arctic winter set in and the sun rose no longer. Day could not be distinguished from night except by a faint streak on the horizon. The capture of seals, the flesh and fat of which formed the principal sustenance, became almost an impossibility, and the absence of blubber prevented the making of fires.

This fearful condition of affairs lasted until the 19th of January when the sun once more shone forth for a short time. On the last of February the provisions were nearly all gone, and one of the boats had been cut up for fuel to melt ice for drinking water. Providentially a lot of Esquimaux dogs drifted on the floe, and these, killed and eaten, furnished food for a month longer. During the latter part of March a heavy gale drove the ice out to sea, and finally broke up the floe on which the houses were built, reducing it from a field of five miles in circumference to one of twenty yards. On the 1st of April the danger became so great that it was decided to abandon a large stock of meat, clothing and other articles and regain the main pack. This was done, but another tremendous storm arose, smashing the ice into smaller fragments. Starvation seemed now imminent, for it was impossible to hunt around for seals. Luckily a polar bear ventured on a marauding expedition into the camp, where he met an untimely fate from the rifles of the men. His flesh supported the party until their rescue. More bad weather took place until they drifted further south and encountered smoother sea. On the 29th of April two steamers were sighted, but the signals made were not seen. The disappointment was, however, atoned for on the morrow, for the British sealing steamer Tigress accidentally, in a dense fog, ran against the very floe of ice which bore the survivors. Their rescue was speedily accomplished, all hands being not only alive but even healthy and well. The Tigress carried them into St. John's, where steps were immediately taken to restore them to vigorous health. It will be understood that their perilous adventure and strange rescue made them objects of both curiosity and commiseration to the people of Newfoundland.

The scientific results of the Polaris expedition are of course nothing. Captain Tyson, to whose courage and firmness the safety of the rescued party is due, states that near Robeson channel he found many marine fossils, which indicate that the locality was once the bed of the sea. No traces of any permanent habitation of Esquimaux were discovered. History furnishes no parallel to this wonderful voyage. The escape of the crew of the Hansa, of the German north polar expedition, by the same means, is thrown far in the shade. The Hansa was crushed in the ice off Greenland in October, 1869, in lat. 70° 49′, long. 10° 51′. The men, fourteen in number, took to the ice and built a snug house out of patent fuel. They drifted 1,100 miles and, on June 14, 1870, arrived at Fredericksthal, on the other side of Cape Farewell. Their cruise was longer than that of the Polaris party, but they only drifted 10° of latitude, while the latter sailed over 24° 35′ and besides lived in constant peril.

A vessel, it is stated, will soon be dispatched in search of the Polaris; and if there is a clear way through Robeson channel, it is probable that the expedition will press on toward the pole. At least we shall have some information as to the fate of the ship and her remaining crew, which will, perhaps, clear up the mystery surrounding the statements of the rescued men.

AMERICAN EXHIBITS AT THE VIENNA EXPOSITION.

A facetious correspondent of one of the daily journals in this city recently, in a lofty flight of humor at the expense of the United States exhibit at the Vienna show, asserted that our sole products there to be found consisted of some bottles of Mississippi water, a dentist's chair, a case of Colt's revolvers, one stuffed eagle and a few other etceteras which we do not just now recall. The paragraph, we notice, has been extensively copied, and in many instances we find it accepted by country exchanges as sober truth, and published in connection with editorial comments. It might be supposed that so ridiculous a statement would need no explanation, but for the benefit of our journalistic brethren who have innocently put their faith therein, as well as for general public information, we condense from the columns of *Engineering* the following description, showing the true state of our representation in Vienna.

The space allotted to the United States is altogether 70,000 square feet, which is rapidly filled as quickly as the disorganized state of affairs incident to the charging of the commission and the slowness of the workmen will permit. On the opening day, the condition of the transept was screened from view by two large barricades formed of packing cases which, stretching across the space, were covered with cloth. Upon them were placed a heterogeneous mass of exhibits which, however, made a good show and hid the chaos beyond. This, it will be observed, does not accord with the *Herald* reporter's description: that our department looked like "an abandoned railway town on the plains." *Engineering's* correspondent adds that within three weeks (about the present time) all should be in good order and all the machinery in motion.

Our section of the machinery hall will be remarkable on account of an absence of steam engines. True, there are four engines, but these can scarcely be regarded as exhibits; they are rather necessary appliances for the machinery in motion. Of these engines two small ones stand, one in each side aisle of the hall, one in the northern side of the main body of the hall, to drive the machine tools, whilst the fourth, a large horizontal engine, is on the southern side, and will work the wood-working machinery.

It had been hoped that some large engines of the Corliss type would have been exhibited, but this was found impossible. The horizontal engine, before mentioned, is but a small one, with a cylinder 12 inches in diameter and 24 inch stroke, and is only remarkable for the rapidity with which it was constructed. It was built at the Norwalk Iron Works in less than three weeks, the iron of which it was made having been lying in pigs at the works 20 days before the vessel, placed by the Government at the disposal of the exhibitors, quitted Brooklyn navy yard. The steam for working the four engines in this section is obtained from an ordinary horizontal tubular boiler, made by Messrs. Pitkin Brothers, of Hartford, Conn., and was sent over by them, not in any sense as an exhibit, but simply to help towards maintaining the credit of the section.

It will be seen, from what we have said above, that the mechanical exhibits in the hall may be divided broadly into four groups, light machinery being in the north and south aisles, and, in the center of the hall, machine tools on the one hand and wood-working machinery on the other. Close by, at the extreme end of the hall, there is a great exhibit of Fairbanks' weighing machines, the largest having a capacity of 30 tuns, whilst others (there are about thirty in all) range from 4 or 5 tuns down to the smallest sizes made.

The United States section is exceptional in having erected shafting in the side aisles. This shafting, as well as that for the wood-working machines, has been supplied by Messrs. Jones and Laughlins, of Pittsburgh, the shafting supplied in the exhibition not being suitable for the light tools and the wood working machines. Specimens of this shafting, as well as examples of pulleys, hangers, special castings for agricultural implements, etc., are shown by these manufacturers, close beside the stand of the Ramapo Wheel Works, of New York. This is in the north aisle, where are also the Woodbury Brush Machine, a circular loom and other textile machines, some pumps, and several smaller exhibits. In the south aisle the most interesting exhibit will be a series of machines for making shoes; these machines, of which there will be about twenty, are sent, like most of the exhibits in this section, from New England. Some printing and stereotyping machines will, with others of minor interest, fill the remainder of the available space in this aisle.

Conspicuous in the main part of the hall are the exhibits of Messrs. Sellers and Co., Philadelphia. Amongst them we may mention in this general notice a mechanical puddling plant, rolling mill housings, a slotting machine, a lathe, a planing machine, and a 650 lb. steam hammer. Messrs. Pratt and Whitney, of Hartford, Conn., show fine sets of special tools, sixteen in all, and designed, some for sewing machine manufacture and others for the production of guns, etc.

Messrs. Stiles and Parker, of Middletown, Conn., exhibit presses of different kinds for cutting and stamping metals, embossing, etc. Close by are several milling and screwing machines, exhibited by the Brown and Sharpe Manufacturing Company of Providence, R. I. Messrs. Darling, Brown, and Sharpe, the standard makers of measuring instruments, will show a fine collection of their specialty. This, with perhaps one or two unimportant exceptions, completes the number of machine tools. The wood-working machines, which are also in the center of the hall but on the southern side, are quite numerous and important. Messrs. Richards, London, and Kelley, of Philadelphia, exhibit only one tool, a hand saw of excellent design. Messrs. Rogers and Co. have a good selection of wood-working tools, including planing and matching, tenoning and mortising machines. Messrs. Whitney, of Winchendon, Mass., exhibit five wood-working tools, similar to those shown by them in the Paris Exhibition; but they have besides an interesting series of pail making machines. Messrs. A. J. Fay and Co. also contribute five wood-working machines; as does Mr. Ball, of Cincinnati. A Root blower, a woolen loom from New England, and a few more of which the traces are hardly yet visible, fill the space allotted in the machinery hall.

In the covered garden court, which by the way is an elegant structure, will be exhibited a large number of small labor-saving machines. Amongst these, sewing machines preponderate. The leading makers, indeed, wish apparently to turn this hall into a depot for their wares; thus for the Wilson sewing machine, 2,000 square feet are allotted, for the Singer, 1,000 square feet, and for the Howe, 600 square feet. The other makers follow at a respectful distance, some of them being contented with only 6 square feet. In this same hall Nathan and Dreyfus, of New York, exhibit specimens of lubricators, and pumps of all classes will occupy most of the space which the sewing machines have not absorbed. We may also mention an interesting exhibit contributed by Mr. Pickering, consisting of blocks of sandstone quarried from a great depth, and impressed with the imprint of some primitive monster.

In the agricultural hall entirely devoted to the United States, there are established some finely finished specimens of American reapers and other similar implements. It remains now only to mention the smaller independent halls, in which will be shown, principally, street cars. It was hoped, and in fact arrangements were completed, for the exhibition of some Pullman palace cars, fitted with the Westinghouse air brake. Circumstances, however, prevented the arrangement from being carried out.

SCIENTIFIC AND PRACTICAL INFORMATION.

PRESERVATION OF ORGANIC SUBSTANCES.

M. Laujorrois communicates to the French Academy the following method for preserving organic substances. It consists in adding to the material to be preserved a minute quantity of fuchsin, barely one hundredth part. A vessel filled with gelatin in solution, to which fuchsin had been added eleven months before, was exhibited by the inventor, and although the receptacle had remained open to the atmosphere, its contents were unchanged. Pieces of beef enveloped in blotting paper soaked with gelatin and fuchsin, were found to keep unaltered, the fibers of the meat only becoming somewhat tough and presenting the appearance of gutta percha. By maceration in water for twenty-four hours, the beef became perfectly fresh and furnished a soup in which no disagreeable flavor could be detected. Coffee and other substances were experimented upon with similar good results.

BURNING THE DEAD.

Professor Polli is agitating the subject of cremation of the dead in England. He not only repeats all the well known arguments in support of this disposition of bodies, but demonstrates that, at the present day, when the science of hygiene has made such progress, and especially in a country like Great Britain, where every inch of ground has its value and where the population is out of proportion to the area of the soil, it should be understood that the organic principles emanating from decaying corpses both poison the water and engender endemic maladies.

WEEDS AND THE FERTILITY OF THE SOIL.

Professor Volske, says *Les Mondes*, has found by analysis that, of the *carduus acaulis* and *utricar repens*, two useless weeds which infest fields in France, the first grows principally in soils rich in potash, and the other in soils largely containing silica as well as phosphate and sulphate of lime. It would be a good idea for agricultural chemists to avail themselves of the hint, and, by determining the nature of the ground in which our most common weeds are principally found, thus afford to farmers a ready way of approximately determining the quality of their land.

PREPARING SLIPS FOR PLANTING.

The *Gazette des Campagnes* recommends to dip the extremities of the slip in collodion, containing twice as much cotton as the ordinary material used in photography. Let the first coat dry and then dip again. After planting the slip, the development of the roots will take place very promptly. This method is said to be particularly efficacious in woody slips, and to succeed well in scions of the geranium, fuchsia, and similar plants.

COMBUSTIBILITY OF THE DIAMOND.

An experiment recently made by Mr. Spencer of Manchester seems to prove that under certain conditions the diamond is combustible at quite a low temperature. A South African diamond, strongly colored and of about the size of a pea, was enveloped in refractory clay with a mixture of soda and hydrate of lime, placed in a crucible and then heated on the hearth of a muffle furnace for three days and nights. Although during this period the temperature was not elevated above a cherry red, it was found on opening the mass that the diamond had completely disappeared.

CHANGING THE COLORS OF FLOWERS.

The *Gazette des Campagnes* says that M. Hucghe has succeeded in changing the common cowslip from its natural yellow to an intense purple by merely transplanting it into richer earth. The color of plants can be readily varied by mixing certain substances with the soil. Wood charcoal will darken the hue of dahlias, petunias, and hyacinths. Carbonate of soda turns the last mentioned flowers red, and phosphate of soda alters greatly the shades of many plants

WATER MAIN TAPPING MACHINE.

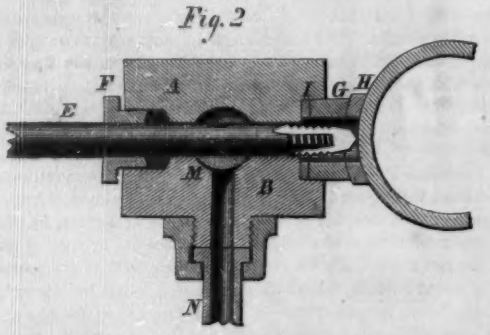
Our engravings illustrate a new and convenient machine for tapping water mains previous to attaching conduit pipes thereto. The operation is one of some difficulty; and as this device is constructed so as to perform its work with rapidity while necessitating but very little waste flow, it will doubtless meet with ready appreciation from plumbers and others requiring its use.

Fig. 1 is a perspective view, and Fig. 2 a sectional view. The two parts of the drill case, A and B, are clamped together by bolts, C, and have a hole formed half in each for the drill, E. At one end is a stuffing box, F, and at the other a detachable washer, G, in a socket, having a concave face to be clamped against the packing gasket, H, on the side of the main to make a water-tight joint. Another gasket, I, is placed at the bottom of the socket. These gaskets and the washer are made in two parts, so as to be removed when the pipe is inserted, as the stop cock on the latter, if they were in single pieces, would prevent their being slipped off over the end. J is the cock traversing the drill hole to close it when the drill is drawn out. It has a handle, K, on the outside for turning it, and has a deep notch, L, cut in it, coinciding with the drill hole, to let the drill pass into the pipe for making the aperture when it is adjusted to the position represented in Fig. 2.

After the hole is drilled and the point of the drill is drawn back beyond the cock, the latter is turned so that the part, M, comes up and stops the orifice. The instrument is then removed, and the pipe to be screwed in is inserted. The cock being turned back again, the pipe is pushed forward and connected with the main, after which the apparatus is detached.

The passage, N, for blowing out chips by the water may either have a pipe connection fastened to it for conducting the washings away by a flexible pipe, as shown, or it may be entirely closed by a screw cap, to be taken off when the drill case is to be washed out. The apparatus is clamped to the main by the ordinary clamps clearly represented. O is the feed screw for the drill, the latter being operated by the ratchet pawl and lever, P.

Fig. 2



The inventor has recently patented an ingenious improvement on this device which will shortly be published.

Patented through the Scientific American Patent Agency, March 18, 1873, by Mr. William Young, of 67 Northampton street, Easton, Pa., by addressing whom further particulars may be obtained.

IMPROVED CUTTING NIPPERS.

Mr. Frederick A. Adams, of Shelburne, Mass., has recently patented the improved tool represented herewith. To the jaws are fastened two cutters which are alike, one of which is attached to the jaw, A, by the screw, B, and by a dovetail having its angle at C. On the jaw is a projection or flange, D, and on the cutter is a corresponding depression or socket. The arrangement and direction of the screw, B, indicated by the dotted lines, is such that, by turning the same, it tightens the cutter and jaw on both surfaces of the dovetail. The flange, D, serves to receive the strain, so that cutting with one end of the cutting edge does not force the other end of the dovetail, and also holds the parts firmly together, preventing looseness.

Fig. 1.

Fig. 2.

Government Experiments on Boilers.

General D. D. Smith, Supervising Inspector General of Steam Vessels in the United States, lately informed the Master Mechanics Association, as a matter of importance to them, that Congress had appropriated $100,000 for the purpose of experimenting to discover the cause of boiler explosions. The experiments would be made during the months of September, October, and November next, at Pittsburgh or Cincinnati, and Sandy Hook, N. J. An effort would be made to find the cause of explosions, and in this master mechanics who navigate the land were as much interested as those who navigate the sea.

Persons who have suggestions to make in reference to the experiments should address General Smith, Treasury Department, room No. 28, Washington, D. C.

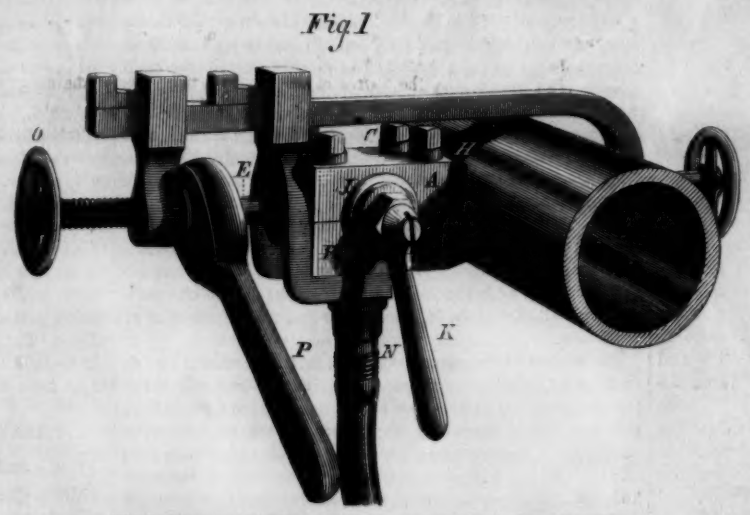
MINER'S DRILL BAR AND BITS.

Few are aware of the dangers, incurred by the miner in pursuing his perilous avocation far under the surface of the earth, from the premature explosion of blasts; nor does the public generally realize the large number of men annually killed and maimed by such disasters. During the year 1871, in the anthracite coal fields of Pennsylvania, 44 miners were thus slaughtered, and it is stated that the number of wounded, the majority of which were rendered totally blind, reached almost incredible figures. These casualties are due in great measure to carelessness in the use of powder, but more frequently to the ignition of the charge while tamping or while withdrawing the cartridge from a miss-fired shot, through sparks made by the striking of the iron or steel bar against the rock. That so easily prevented a danger should not, ere this, have been permanently averted by suitable devices is a subject of wonderment; though perhaps the circumstance is accounted for by the fact that inventors seem to have overlooked the miner, and allowed him, so far as implements and safeguards are concerned, to fall behind workers in other industries. The invention which we herewith illustrate is, however, a long step toward the amelioration of present difficulties, especially by the substitution of copper for iron. It consists in a bar for miners' use, to which tools or points may be adjusted as required. By this means it is claimed that a single instrument is substituted for the ordinary number (three to seven) of drills employed, which average in weight from 18 to 22 lbs. each. The necessary of carrying such a heavy weight of metal in and out of a mine or to and from a quarry, in order to have the bits dressed, is thus avoided, as the latter weigh but three or four pounds each, and can be detached from the bar at the pleasure of the workman. The bar is of the usual description and is provided with a screw-threaded socket at its end for the connection of the several tools, which are fitted with a corresponding screw-threaded projection above a shoulder. One of the ordinary bars now employed can be readily altered for the purpose by any blacksmith, at a small cost, so that the miner will only have to purchase the necessary bits. A is the diamond or pick pointed tool of steel, and is calculated for working off masses of coal or rock that have been loosened by blasts in places where it may be dangerous to use a short-handed pick or inconvenient to employ an ordinary bar. B is the copper reaming drill for reaming out holes in which the charges have failed to explode. C is a tamper (of copper, so as not to strike fire while tamping the charge, thus avoiding the danger of premature explosion) which is attached to the bar by a shank, D, so that less copper will be wasted when the tamper head is worn out. The crowbar-shaped end of the bar, E, is of steel. F is the steel pointed drill bit for ordinary use, and G an end view of the same.

An especial advantage of this bar is that it can be used for deep or shallow holes by simply adding to the length of the tool. In brief, in this single invention the miner or quarryman is at once provided with a pick pointed bar, crow bar, copper drill, copper tamping bar, and any number of steel bits, the whole adding but little weight, over a single drill of the kind ordinarily employed, to his kit of tools.

Patented through the Scientific American Patent Agency, April 22, 1873. The inventor, Mr. R. B. Platt, is a practical miner of some 30 years experience. He may be addressed, for further particulars, at Hazleton, Pa.

Fig. 1



YOUNG'S WATER MAIN TAPPING MACHINE

Hudson on Liability to Disease.

Dr. Alfred Hudson, in a recent lecture reported in the London *Medical Record*, pointed out various causes that predispose the body to disease, rendering it liable to suffer from contagion; and after referring to the various theories with regard to contagion, he stated that he believed typhus fever had its origin principally from overcrowding, and was not so much the result of contagion.

The importance of the study of predisposing causes in a sanitary point of view rested in a great degree upon three considerations: first, that liability to zymotic disease exists in different persons in different degrees; secondly, that its amount varies in the same person at various times and under various conditions; and, thirdly, that many of these conditions are preventable. He remarked that fatigue was one of the most frequent of the causes that predispose to disease, and that this was shown in the case of soldiers who suffered so much after long marches, often exposed to the worst influences of the weather. Dr. Hudson concluded an able and exhaustive lecture, by stating that the following were some of the conclusions to be arrived at from the facts that had been adduced: 1. That liability to zymotic disease may be considered inherent in our constitution—a law of our nature. 2. That this varies in degree in different individuals at different times and under different circumstances. 3. That these circumstances are partly external, or extrinsic, and partly intrinsic conditions. 4. That both are partly preventable and partly non-preventable. 5. That, *cæteris paribus*, liability is least in those in whom healthy blood, healthy tissues, and healthy excretion coexist, constituting perfect nutrition. 6. That it is greatest in those whose blood contains the greatest amount of the products of waste of the tissues and of matters in a state of decomposition introduced into the circulation from without.

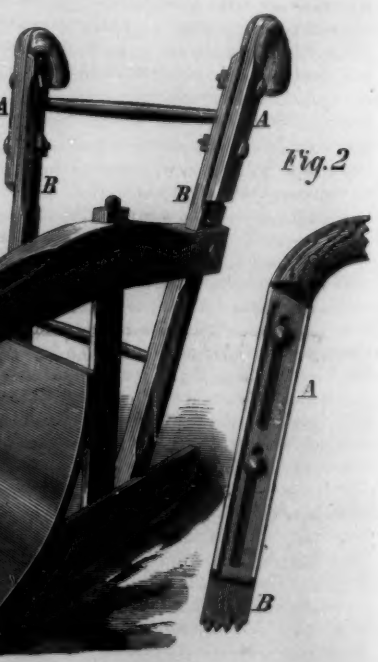
IMPROVED PLOW HANDLE.

The invention herewith illustrated consists in arranging the handles of a plow so that they may be raised or lowered to suit the stature of the plowman, and may be readily attached or detached from the implement.

The portion grasped by the hands is secured to curved metal bars, A A, which are slotted as shown more clearly in Fig. 2. Through the apertures and through holes made in the fixed arms, B B, of the plow, headed bolts are passed which are secured by nuts on their inner ends. It is evident that, by loosening the latter, the handles can be elevated or depressed the length of the slots, or, by removing the bolts, can be detached from the plow altogether. The inventor claims that this apparatus is strong and durable, can be used in connection with any plow, and attached thereto by any person, thus saving the expense of the work of a skilled mechanic. For further information regarding interest, rights, etc., address the inventor, Mr. J. T. Raftery, El Dara, Pike county, Ill. Patented April 29, 1873.

Fig. 1

Fig. 2



A COLLAPSING LIFE BOAT.

The Rev. E. L. Berthon, of Romsey, England, has devised a very novel form of life boat which can be caused to collapse, or rather be folded into an extremely small space. The invention is one which at the present time will excite a widespread interest, as it seems based on correct principles and to be an efficient and valuable device. It need not be pointed out that by its use passenger steamers can not only readily carry a number of boats amply sufficient to save every soul on board in case of wreck, but even several extra ones in the hold, which may be employed to bear provisions, or may serve good stead in event of the davit boats being disabled by the careening of the ship, as in the Atlantic disaster.

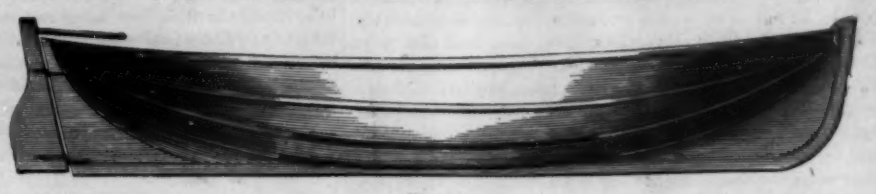


FIG. 1.

In our illustrations, for which we are indebted to the *English Mechanic*, Fig. 1 is a side view of the invention; Fig. 2 a section of a part of a ship's side with a boat attached, both shut and open, and Fig. 3 a gunwale plan. The length of the boat is 36 feet. The frame work consists of fore and aft timbers, generally four on each side of the keel, jointed together at each end on the top of the stem and stern pieces. These timbers are made broad and flat. Their position, when collapsed, is vertical and parallel, like the leaves of a closed book when on its edge. When open, they stand out at various angles on planes radiating from a line drawn from the top of the stem to the top of the stern.

FIG. 2.

There are two skins, of an enormously strong but flexible material, one of which is attached to the outer edges of all the timbers and the other to their inner edges. The falling open of the boat extends these skins, and the whole body of the boat is thus divided into eight separate compartments, which inhale their proper bulk of air in the act of opening. As dingies for small yachts, for which they are admirably adapted, they are made in a more simple manner, with only three timbers on each side of the keel.

A life boat 12 feet wide is stowed within the space bounded by the black line, *a a*, Fig. 2, which is a covering of very strong canvas; it is protected below by a kind of channel, *b*, the davits, *d*, being topped up, that is, in a vertical position. The boat is secured in place by strong gripes, which bind her fast to the bulwarks. When these are cast off, the davits drop, into the position represented by the dotted lines, with the boat, which immediately opens by its own weight; *c c* is then its midship section, the shaded parts representing the air cells.

The Mother Lodes of the United States.

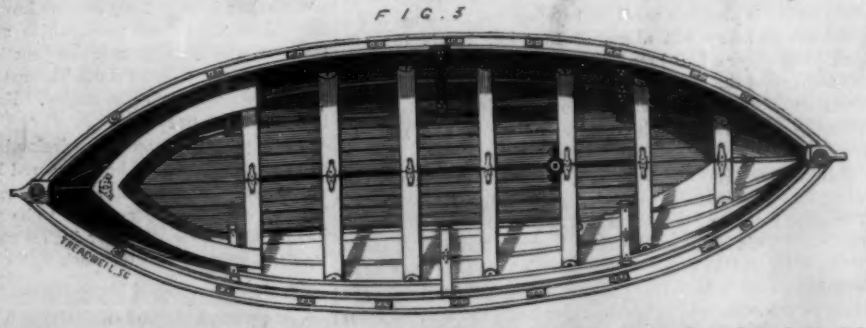
Since its discovery in 1859, the Comstock has produced nearly $150,000,000, and has been worked with more energy than any other vein upon the continent. A depth of 1,800 feet and over has been reached upon the vein, and as yet no deterioration found in the quality or quantity of the ore. The limit of advantageous mining from the surface has, however, been nearly reached, and were it not for the provision of the Sutro Tunnel, which will cut and drain the lode at a depth of 2,000 feet, the Comstock would soon have to be abandoned as unprofitable.

The Raymond and Ely mine is of very recent location, but is producing at present a larger amount of bullion than any one silver mine, under one management, in the world. Over $4,000,000 was yielded in 1872, and an idea can be had of its value from the fact that the local tax upon its bullion produce for the first quarter of 1873 was $18,000.

The Moss lode of Arizona has, as yet, received no extensive developments, and only claims a place among the list of mother lodes on account of its great length. It is silver-bearing, and may probably become one of the great veins of the future, when the Apache is no more, and the Southern Pacific railroad is an accomplished fact.

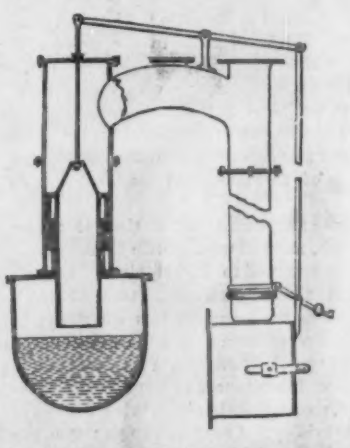
Last, and greatest of all, in extent, production and size, is the great California gold vein, or the mother lode of the Sierra Nevadas. This fissure has been distinctly traced with occasional interruptions for nearly 80 miles. A line drawn on the map from Mariposa to Amador would not depart from the course of the lode more than two or three miles at any place. At the crossing of the main rivers it is lost almost always, but again found on the bluffs beyond, in places cropping out like a wall of quartz for miles. Besides having been in all probability the source of many of the rich placers and bars that have yielded their millions of gold, the lode is worked in a great number of locations with success. The metal is found in fine particles quite evenly distributed in the chimneys and pockets, and existing in smaller quantities in almost every part of the vein. The most prominent mines now working upon it are the Amador, Keystone, Hayward, Loring, McAlpine and others.—*Mining Review.*

FIG. 3



CHANDLER'S PATENT DIP PIPE.

We extract from the *Journal of Gas Lighting* the accompanying engraving of a new invention, known as Chandler's patent dip pipe, the object of which is to regulate the depth of seal in the hydraulic main by an ingenious contrivance which either raises or lowers the pipe into or out of the same, and so gives the dip required.



The seal cup is charged with tar, which permits the movable dip pipe to be lifted into or out of the main. It will be seen that the lid cannot be removed from the mouthpiece until the handle is raised, which removes the lock and seals the dip. When the retort is again charged, and the lid fastened by bearing down the handle of the lift, the lid is locked and the dip is again raised.

The advantages claimed are an unobstructed passage for the gas, no deposit of carbon on the retorts, increase in the quantity of gas made, saving in fuel, economy in wear and tear of retorts and in labor, and the saving of the time occupied in scurfing, as necessitated by the old systems.

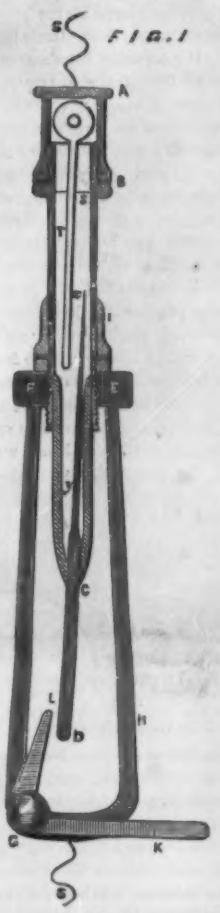
A NEW DEEP SEA THERMOMETER.

Among the recent scientific instruments, the invention of which is probably due to the impetus which deep sea investigations have recently received, notably by the voyages of the Hassler and school ship Mercury and the present expedition of the Challenger, is a new thermometer for measuring the temperature at great ocean depths. The device is that of M. Dietrichsen, a Norwegian, and possesses the advantage of indicating the degree of temperature of the water at several different distances from the surface or bottom at one sinking. We reproduce our illustrations from the pages of the *English Mechanic*.

The principle is briefly as follows: A small thermometer, protected against water pressure, is sent down to the desired depth. By suitable arrangements the thermometer tube is abruptly broken off, and from the column of mercury remaining in the separated part the temperature is inferred. A thermometer is thus, of course, lost each time, but the kind used are very cheap. The mercury is not lost.

The arrangement is as follows: A E (Fig. 1) is a brass tube, the upper part of which, A B, is screwed on at B. The piece E C is of lead. C D is a thick brass wire, about which the lower end of the lead tube, E C, is soldered, and which is continued up into the tube as a thin but pretty stiff lamina, resting against the inner side of the tube when the lead pipe is bent; this lamina is pressed towards the opposite side. The entire tube can be screwed into the brass case, F G H. At G there is an arm, L G K, bent at right angles, and turning about G. At A and G are attached two spiral brass wires.

FIG. 1

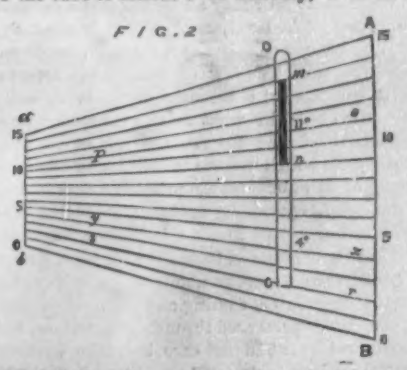


The thermometer, T, having a length of 4 inches, is stuck in a piece of cork. A mark is made with a file on the thermometer tube near the cork, which is so fixed in the mouth of B C that the mark is on the same side as the lamina, *x y*. The apparatus is made fast to the line by the spiral wires.

When it has been sunk to the required depth, it is allowed to remain five or ten minutes, that the thermometer may take the temperature of the surrounding water. A ring-shaped weight is then allowed to fall, and this, gliding over the tube, presses on the arm, L G K, whereby the lead tube is bent, and the thermometer is broken off by the lamina, *x y*, at the file mark, *s*. If there are several apparatuses on the same line, the ring breaks off the several thermometers in succession. In its descent it also liberates a stone which is used to sink the apparatus.

The graduation and subsequent reading of the thermometer are effected in the following way: When the thermometer has been filled and closed by heating, two points are taken on the scale, say at 4° and 20°, the tube beyond the cork having previously been marked throughout its length with a stripe of white oil paint; and this is then scraped off above and below the points mentioned. The degree numbers can be marked at the extremities. When the thermometer has been broken, the reading can most simply be effected by means of the scale represented in Fig. 2. The parallel lines, A B and *a b*, differing in length, are each divided into a corresponding number of equal parts, say 15. Straight lines join the corresponding points. Suppose the severed piece of the tube to inclose 7° of mercury, 4° to 11°. The piece, C D, is laid on the scale parallel with the line, A B, so so that the mark 4° is on the line, *x y*, and the mark 11° on the line *o p*. The broken end, C, will then, for example, fall on the line 2, *r s*. The column of quicksilver, *m n*, reaches thus, from the line 9 to the line 14. The required temperature is therefore $=2+(14-9)=7°$

FIG. 2



THE WONDERS OF THE EGG.---IV.

[LECTURE BY PROFESSOR AGASSIZ.—CONCLUSION.]

When you bring an egg (the spawn of fish is perhaps the easiest subject for the investigation) into contact with the contents of the sperm cells, that is, with spermatic particles, you will see these particles crowding with their quick sudden movements around the egg and covering its surface. At particular seasons of the year in some of the hermaphrodite mollusks, these particles may be seen in numbers around the eggs. It would seem that at such times nothing could be easier than to trace their functions. The great movability of the particles, however, and the difficulty of keeping any one of them in the focus of the microscope, makes the operation an exceedingly delicate one. The crowding of the particles about the eggs of a variety of animals is indeed easily seen; in fishes, in the mollusks mentioned above, and also in sea urchins and star fishes, and even in jelly fishes. It is more difficult to observe in the higher animals and among insects and crustacea.

Although the introduction of the spermatic particle into the yolk is so difficult of observation, there are investigators who have seen this phenomenon repeatedly. Siebold, a master among masters and an observer who never exaggerates his facts, has seen the spermatic particles within the yolk membrane of the bee's egg more than 20 times, and has been able to show this to others. I have spent months in trying to find it in the eggs of turtles, and have never succeeded. But my own failure does not in the least diminish my confidence in Siebold's results. His capacity for observation is so admirable, his results are so free from exaggeration or personal bias, that his statements may be accepted without a question. To his demonstration we owe our first absolute knowledge of this phenomenon; and in some animals the spermatic particles penetrate into the yolk more easily than in others, owing to the openings in the envelopes of the yolk—the so-called "micropyle"—through which the introduction takes place. But under any circumstances these "micropyles" are difficult to watch. So experienced an observer as Bischoff, at the time he published his magnificent embryological monographs on mammalia, had never had the good fortune to see a spermatic particle penetrate into a mammal egg, or to detect one within the egg. He indeed, doubted and controverted the fact until it was demonstrated past all question. The nature of the special influence exercised by the spermatic particles in the growth of the egg is not yet ascertained; but this much, at least, we know with certainty, namely, that the spermatic particles penetrate into the yolk, and that the material combination thus taking place between the substance of the spermatic cells and the substance of the ovarian cells influences in some way the production of a new being. And yet we have seen that this combination is a necessity, not an invariable law, since eggs undergo the whole process of reproduction and give rise to new beings without any such contact. Of this I shall have more to say when we come to the consideration of those animals in which the new being is produced without fecundation.

TRANSMISSION OF HEREDITARY CHARACTERISTICS.

The question of inheritance, transmission of qualities from individuals or one generation to those of another, or of many succeeding generations, is very perplexing, considered with reference to the above facts. I have shown you that the egg is entirely the product of the female organism; that it grows to its perfect condition as an egg without any other stimulus than that furnished by the mother. When fecundation takes place it acts upon the ripe egg alone; it has no power to produce an egg, and exerts an influence only upon eggs which have already reached a certain degree of maturity. And yet notwithstanding this independent production of eggs by the female, the male influences the progeny quite as powerfully. We have only to look among our domesticated animals, or indeed among ourselves, to know that features are handed down from the maternal and paternal side equally, and reappear in direct succession among the the children, and that this occurs, as I have reminded you in a former lecture, in all possible combinations. Still more curious is the fact that certain things acquired by an individual during his lifetime, and therefore essentially his own and not inherited in any way, may be transmitted to his progeny, and may even reappear in subsequent generations. I do not here allude to the so-called law of "atavism," but to a seemingly capricious reappearance and disappearance of all sorts of individual, mental and physical qualities. They may all be transmitted or may all be dropped as a new generation appears. And yet, with all their plasticity and power to assimilate or to reject new features, we do not find that species change. The law of inheritance seems so ordained as to retain what is essential to the type, and to allow of variation only in what is not characteristic of the typical organization. At all events, as far as we can trace the animals with which we are familiar now—and we can follow many of them beyond the primitive ages of mankind into the geological epochs immediately preceding and connected with our own—we find no indication whatever that any animal has ever swerved from his own type. Slight variations occur, such as occur about us every day, but they are individual differences, coming and going with new generations, sometimes preserved through generations, and even when maintained by intelligent care becoming permanent in what are called breeds, but never affecting typical structure We must, as it seems to me, look upon the law of inheritance as intended to preserve, not to diversify, types; active only so far as to introduce freshness, a constant renewal of individuality, as it were, but never impairing original patterns or norms.

PERSISTENT TYPES—THE LACUSTRINE EPOCH.

I shall show the persistence of type in more detail when we examine the successive introduction of organized beings in geological times. I allude to it now only with reference to what are known as prehistoric times, and especially to the prehistoric times to which humanity itself belongs. In the lacustrine dwellings of Switzerland there lived a race of people, all record of whose existence had faded before the Romans made their incursions into Gaul and Germany. Cæsar's armies in their invasion of Gaul passed over regions of country once occupied by these lake dwellers. Roman roads still exist along the shores of the Lake of Neufchatel, built upon their remains, and yet the great Roman general and historian knew nothing of them. Their ruins lie under the water, the dwellings having been built out upon piles into the lake, no doubt for greater security. The windows of my father's parsonage at Concise looked down on such a buried settlement, though we did not then know of its existence. As a boy I played in its immediate vicinity; in later years, on my last visit to Switzerland, when the cutting of a railroad along the lake shore had revealed the story so long hidden, I gathered implements, worn bones, etc., on the spot myself. In these ancient dwellings, remains are found of our domesticated animals and of our cultivated plants. Bones of pigs, dogs, cattle, deer, etc., and wheat, oats, cherries, nuts, and the like have been found within the precincts of these lacustrine dwellings. These relics do not differ in any way from the products of the same kind in our own time. The facts here given sustain me in the belief that inheritance is a device of nature to maintain type, and to preserve essential and characteristic features, generation after generation. It is true that, ancient as these lacustrine dwellings are, when compared with any historical chronology, they are modern as compared with the early geological periods. But those early periods, far before the introduction of man upon earth, furnish evidence of the same kind, and form part of a coherent history leading to the same conclusion, as I shall be able to show you when we examine the animals and plants belonging to them.

INHERITED TRACES OF SURGICAL OPERATIONS.

But while the office of inheritance is to preserve typical features, its power to transmit individual peculiarities is also wonderful. My friend Dr. Brown-Séquard, who has made more experiments among animals than any man living, continuing them upon successive generations and ascertaining what diseases may be transmitted, has stated facts to me which almost defy belief. These facts are unpublished. I will give a few of them. He has found that the disease of epilepsy can be induced in guinea pigs by certain operations, and that this disease, being so introduced into the system, may be transmitted from generation to generation, and thus become hereditary. Where such operations have produced malformations of the skin, as is often the case, these also have been transmitted; or where the paws have been affected by such operations the peculiarity has been also transmitted. Malformation produced by these experiments as a disease during the life of a parent has been passed down to the offspring, and even habits arising from disease have been inherited in the same way. In one such case the peculiarity existed in the female; in another it was produced in the male. In the latter instance the male transmitted its own diseased condition to another generation through a healthy female. More than this, the female through whom these diseased descendants had been produced eventually became herself diseased in the same manner as the male. These facts have a fearful significance. With reference to the process, the subtle influence by which such results are produced, we must be silent for the present, since we cannot explain or understand it. All that we know is that a material combination takes place which enables us to say that these individual peculiarities are sifted through the egg of the female and the spermatic particles of the male, and may reappear in their progeny.

A still more surprising fact is that of a man who had a diseased tooth, marked with a little black speck. This slight mark was transmitted to his children. Is such an inheritance brought about by a material transmission? It will be long before we shall answer this question; but all these facts have a direct bearing upon the question of maintenance or change of type. Therefore, I return again and again to this subject of inheritance, and try to illustrate it from all sides In direct connection with this question of inheritance is that of hybridity. I have shown you that the progeny of closely allied animals may resemble indifferently the male or female from which they spring. All the descendants may be like the one or the other parent, or may share the characteristics of both. But whenever animals of different species cross with each other, as for instance the horse and donkey, the progeny is always a medium between the two—neither a horse nor a donkey, but a mule. In other words the offspring is always a half breed, always intermediate between the father and the mother. Among animals this occurs between what are called species. Among men it occurs between what are called races. The children of whites and negroes are neither blacks nor whites—they are mulattoes. The children of negroes and Indians are neither the one nor the other, but are half breeds, having characteristics of both. The same is true of the white and Australian, the white and Chinese. This is one of the facts brought forward in favor of the independent origin of the races of men. It has been on this account inferred that they must be distinct from each other in the same way as species of animals are distinct from each other. I will not dwell upon this point, but only ask what bearing these facts have upon the preservation or alteration of type. What is the next step? Suppose that in the next generation the cross takes place between the half breed, we will say a mulatto and a white, or between the mulatto and a black, and this continues for two or three generations? The mixture is then completely gone, and we revert to the pure type. The same is true of animals; we may produce hybrids or half breeds; but put them for a generation or two with their own kind, they have no power to transmit the bias they have received, but their progeny revert to their own original norm. It seems to me that this is very strong evidence that all these laws of inheritance and transmission tend to the maintenance rather than to the diversification of type.

SANITARY NOTES.---DRAINAGE FOR HEALTH.

The chief object of this paper, contributed by Hon. H. F. French, to the fourth annual report of the State Board of Health of Massachusetts, is to show, to people living in the country, how practically to render their homes more healthful, by draining off the natural surplus water from their building sites and surroundings, and by carrying away and rendering harmless and even useful the outflows of sinks and other receptacles of filth.

DRAINAGE OF BUILDING SITES.

To drain a tract large or small, one acre or ten-thousand acres, find an outlet low enough to give the necessary fall. One foot in a hundred is sufficient and the author has drains working well that have but a quarter that fall. Common drain tiles are recommended, as they are cheaper and more durable than stone. They can be purchased at a cost of about 2 cents each for two inch, 4 cents each for three inch, and 6 cents each for four inch; these are the only sizes necessary. They are usually about 12 inches long. If the four inch are not large enough, two or more lines of them abreast may be laid. If tiles cannot be procured, stones, bricks, or wood may answer the purpose.

LAYING OUT THE WORK

should be done before breaking ground; generally a day's service of a good engineer, to fix grades, etc., will be worth far more than it costs. Usually a single main drain should run through the lowest part of the tract, and it is not important that the main should be straight. Lay side drains into it, having always in view two principles: first, to run each drain up and down the slope of the land rather than across; and second, to have them parallel to each other. The depth should be four feet or more and the distance apart with this depth may be from 30 to 50 feet. In any soil, except a close clay, 50 feet apart will be safe. In

OPENING THE DRAINS,

begin at the outlet, so that the water may run off as the work proceeds; with a common spade, and a pick if necessary, cut a trench by a line eighteen inches wide at the surface, narrowing to four inches or the width of a laborer's boot, at the bottom. The laborers will insist that they cannot work in so narrow a trench, and probably convince their employer, who of course has a right to follow their advice and waste his money if he pleases. To finish the bottom, a spade four inches wide is needed, and may be made by getting a blacksmith to cut down a common long handled spade to that width, no wider at the heel than the point. This is the only peculiar implement necessary, all the assortment of "draining tools" being only valuable to sell. Having opened all the drains, keeping the main low enough to let off the water, we begin to lay the tiles at the upper end. If there is much fall and there is danger that the main or the lower end of it may cave in, it may be only partially excavated at first, just enough so that the water may run off from above.

Lay the first tile, usually of two inch size, with a brick or flat stone over the upper end to close it entirely, and the next end to end with it, and so on to the main, keeping always an inclination, however slight; for if any depression is made, the silt will lodge in it and obstruct the work. No water is to be admitted except by percolation through the soil, and it enters chiefly at the joints which are as close as two rough bricks laid end to end would be.

Having laid two or three tiles on the bare earth, if hard, and on laths or other thin wood, if soft, cover each joint half or more round the tiles with a piece of tarred paper as large as a common letter envelope; and holding the whole firmly, place soil or gravel over it and on both sides of the tiles, pressing it enough to keep them in place. However tempted to do so, put no stones, nor straw, nor shavings into the drain. Cover and fill up with anything at hand except soft clay or fine sand, which should not be placed in contact with the tiles. Sole tiles, having flat bottoms and egg shaped orifices, the small end downward, are much used, but round tiles have the advantage that they may be turned so as to get a better joint. They require however more care in laying unless collars are used, which add 50 per cent to the cost. When we approach the junction of the minor drain with the main, a curve should be made, so as not to bring the side streams at right angles. Branch tiles may be obtained for this purpose.

Having thus connected the drains, in one system with only one outlet, this should be so secured by a wire grating that no frog or other creeping thing can explore it. It should be built up solid with stone so as to be permanent, and should have a clear fall of a few inches upon a flat stone that it may not be obstructed by back water and mud.

HOW TO DRAIN CELLARS.

The common method of draining a cellar of a New England country house is to construct a small stone culvert running from the lowest corner of the cellar to some low place a few rods distant and digging small trenches across the cellar

bottom leading to this outlet. Such a drain is very imperfect, as it readily clogs and admits small animals. The writer considers that the best mode of cellar drainage is exemplified in the method adopted by himself in a house where, at certain periods of the year, the water in the cellar stood sometimes two feet deep. Having taken levels, it appeared that a low tract some distance off gave sufficient fall, when a trench was opened from that point to the nearest corner of the cellar. This was made about 4 feet deep except near the house, where a depth of 9 feet was reached, tunneling under roots of trees, walls, etc. In the cellar, the drain was continued to the farthest corner, one foot below the surface. Common two inch drain tiles were used inside, then three inch for some distance, and lastly, four inch to the outlet. The joints were covered with tarred paper and the soil returned and levelled. The outlet was secured by a little wall of stone and a copper netting, placed over the last tile completing the work. The whole cost of this arrangement did not exceed $25, and not a drop of water has since been in the cellar even in the wettest seasons. In cases of buildings on a slope or hillside, having a subsoil not readily permeable by water, the cellars often become reservoirs. It is best to catch the water before it enters the cellar and so avoid all dampness by running drains, on one or more sides of the buildings, outside the walls. Cementing a cellar to exclude water is not advisable, for the pressure of the fluid heaped up behind the wall to the surface is often sufficient to lift up the whole body of cement from the bottom and break it in pieces. Water it is true can be thus, if a heavy wall is used, excluded, but the process is expensive and the adjacent soil is left saturated.

WHAT MAKES THE WATER BAD?

The answer is, too frequently, "because sink drains and vaults empty into the source of supply." A well often operates as a very deep drain, and whatever fluid penetrates the soil tends to flow into it. The subsoil has generally an inclination or dip, and the water tends down the slope. Careful observation will teach the direction of this underground flow, and it is always safest to dig a well on the up stream side of buildings so that the tendency of the natural drainage will be away from the well. A shallow well in sandy soil is far better laid with brick in cement than with stone. All water will thus be compelled to filter through the soil, to the depth of the bottom of the well. Well water is usually worst when lowest, and bad water may be expected, due to fluids from the soil rushing in to supply the place of the liquid pumped out, particularly after a drought. Common privy vaults should be laid with brick and cement, watertight, say of 40 to 80 cubic feet capacity for a common country house. Fill one third full of dry soil of any kind except sand, and add more from time to time, clearing it out two or three times a year for use in the garden or field. If no water is poured or drained in, the contents will be dry and inoffensive when removed. A bed of muck or soil hollowed in the middle, upon which through a spout the chamber slops can be poured, if occasionally changed, will absorb their odor and add value to the compost heap.

SINK DRAINS.

There is no fluid so hard to carry away as sink water. The soap and grease are deposited on the sides of the pipe, which in course of time becomes choked. For this reason, the drainage of clear water should be kept distinct from that of cesspools and sinks. Clear water will flow in half inch pipe while four to six inches is not too large for sinks and cesspools. The joints for the latter must, also be tight, while common drain tiles are open. The following method for constructing sink drains, the author says, is cheap, efficient and durable. At the sink is a common bell trap. A lead pipe of 1½ to 2 inches bore runs down and out through the cellar or ground into a reservoir, which may be a strong oil cask of 50 to 100 gallons, or of well cemented hard brick. It should be a foot below the surface, so that, properly covered in winter, it will not freeze. The lead pipe should discharge under water and thus form a second trap that prevents any air passing up the bore. The outlet pipe, starting about one third up from the bottom, may be of lead, ½ to 2 inches bore, and should run upward and out of the reservoir at about a third from the top and into a large pipe of stone or iron. Thus the water enters the lead pipe about midway from top to bottom, leaving the greasy particles floating on top and the heavy particles at the bottom, so that what runs off is comparatively clear. It still carries off a great deal of soap, and will deposit it for a long distance.

The large pipes fit into each other, and are made tight with cement. They should be carefully laid, keeping always a slope, and a swab should be used to rub down the cement inside as each joint is laid. Three or four times a year the cover of the reservoir should be removed and everything cleared out.

The final deposit or cesspool into which sinks and water-closets are discharged should be placed, if possible, below the level of the water in the wells at their lowest, and always on the down stream side of the well, as the water is supposed to flow in the ground. A large vault, cemented or not as seems necessary, may be supplied with a quantity of dry soil or peat, and the moisture may be thus absorbed, or a trap may be there arranged which shall separate the fluid, which may be pumped out and applied to the soil; or the moisture may be absorbed by the earth, if the conditions are such as to render it safe.

Correspondence.

Transmission of Light.

To the Editor of the Scientific American:

The following thoughts having occurred to me, I would like to learn, through the columns of your indispensable journal, whether they are correct deductions from the facts already known to science.

If light is a wave motion, there must be a medium pervading the space between us and the sun, by which this motion is conveyed. Call it ether. There must also be friction between the earth's atmosphere and the ether, created by the earth's diurnal revolutions. This friction would create electrical currents in an equatorial direction. The earth would then represent a huge electro-magnet, the circumscribing currents inducing polar magnetism in our globe, as similar currents (through the insulated wire,) induce magnetism in the soft iron core of the telegraphic magnet. The magnetic needle points in a parallel line to the great magnet by its side.

Having taken all the numbers of your paper since 1851, and carefully preserved them, I have come to have a confidence in your decision of scientific questions which is almost limitless. CALVIN E. TOWN.

Washington, D. C.

REMARKS BY THE EDITOR.—We will enumerate a few of the objections to which our correspondent's theory is open.

The friction produced by diurnal rotation, if it existed, would be equal at all points of equal latitude; there would consequently be no tendency to produce equatorial currents but only those from the equator to the poles, which would make compass needles point east and west. The air is a sure conductor, and if electricity were developed in the upper regions of the atmosphere it would be visible in its passage as lightning or auroral flashes. There are occasional, not constant, phenomena. Any such friction would have long ago shown its effect in changing the rate of the earth's motion.

The Million Dollar Telescope.

To the Editor of the Scientific American:

I have noticed with much interest the various correspondence and plans proposed for the $1,000,000 telescope, and should regret exceedingly to see any lottery scheme gotten up for the purpose of accomplishing so noble an object. If some distinguished scientific professor of astronomy would accept an invitation to preside over a meeting at Cooper Institute, New York city, after giving the object of the meeting abundant publicity, and then and there a society be organized of men of character to give it public confidence, the money would be forthcoming. For such an object, a society, I think, would be preferable to a company. Let there be grades of membership in proportion to subscription, with table of memorials, and the thing is done. J. E. E.

Beaver Falls, Pa.

Professor Haeckel on the Origin of Man.

To the Editor of the Scientific American:

In an article on page 231 of your issue of April 12, 1873, certain theories of Professor Haeckel, of Jena, are set forth; these, to say the least, are very curious and apparently opposed to every principle of common sense.

In substance, the Professor says that man at the outset is an egg, a little cell the one hundredth of an inch in diameter. The egg becomes an embryo, brought about by the original cellule being divided into two, these two into four, etc., continually increasing in number until a quorum is formed, when they lay their heads together, so to speak, nominate committees to attend to particular duties, and finally, all agreeing, like good citizens, to abide by the laws (made by themselves?), set to work to form a perfect man or woman precisely like those who for thousands of years have been striving to obtain a living from the bosom of their mother earth. But stay, I am too hasty. We are to suppose that in case our present circumstances are ever so altered as to render it necessary that man should become a monkey or a winged individual like the angels our forefathers believed in, then these tiny cellules will go to work accordingly and clothe us with hair or feathers, as the case may be.

What a beautiful theory! What wisdom these little cells display in thus cutting themselves up indiscriminately to build up the perfect man with his noble nature, his glorious ambition, his high attainments!

Can it be possible that any reasonable person would entertain such a theory as the above? Must we be led to believe that particles of matter (themselves composed of elements well known to us) are capable of acting in concert on their own responsibility, as it were, like ourselves, and so creating man to suit the circumstances, as we would construct a government or a machine for certain ends or purposes? Granting even this to be so, then we must go back to the elements of which the embryo itself is formed. By what power are these brought into the form of an egg or cellule? Since the same elements combine to form man and monkey, trees and plants, surely we must look for the original reasoning power in them, if we discard the idea of a Supreme Creator, and not in any particles or cellules formed by them. Thus we have oxygen, hydrogen, nitrogen and carbon transformed into reasoning beings, who either created themselves or have existed through eternity, and have the power of creating at pleasure man, beast or plant from their own substance.

Here we see that certain of mankind, in their frantic endeavors to overthrow the claims of theology and the distasteful idea of a Supreme Being, with power to reward or punish, unconsciously set up a god formed of the elements, who has, at least, the power to create and destroy at will; for we must not lose sight of the fact that to plan and accomplish a given purpose requires an effort of will, be it natural or supernatural, and that there is a vast difference between the controlling influence of mind and the passive obedience of matter to established laws: the existence of which laws itself implies the prior existence of a law-making power.

I would suggest that the learned Professor turn his attention to the moral of an old and well known fable, for his great mountain of words, with monstrous labor, brings forth an exceedingly microscopical mouse of proof for Mr. Darwin, who will surely exclaim "save me from my friends."

Washington, D. C. JOHN LEPPER.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations, which are only approximate, in the following notes, and for most of the information, I am indebted to students. M. M.

Positions of Planets for June, 1873.

Mercury.

Mercury rises on the 1st at 4 A. M., and sets at 6h. 37m. P. M. It is at its least distance from the sun on the 8th.

On the 30th it rises at 6h. 15m. A. M., and sets at 8h. 57m. P. M. It is then approaching its greatest elongation east from the sun, and should be looked for in the evening twilight.

Venus.

On the 1st Venus rises at 2h. 56m. A. M., and sets at 4h. 28m. P. M.

It is at its greatest brilliancy on the 10th, and should be looked for about a quarter after nine in the morning, at an altitude of 61°.

On the 30th Venus rises at 1h. 58m. A. M., and sets at 3h. 52m. P. M.

Mars.

Mars is at too low altitude for the best observations, but is a conspicuous object in the evening sky, coming to the meridian on the 1st at 9 P. M., having risen a little before 4 in the afternoon, and setting at 2h. 19m. the next morning.

On the 30th Mars rises at 2h. 6m., comes to meridian 7h. 19m., and sets at 12h. 30m. the next morning.

A small telescope is sufficient to show the markings on the surface of Mars, and the white regions, supposed to be icy, around the poles.

Jupiter.

Jupiter is still among the stars of *Leo*, and still a beautiful object in the evening sky; it rises in the forenoon on the 1st, and sets at 11h. 58m. P. M.

On the 30th it rises at 8h. 43m. A. M., and sets at 10h. 16m. P. M.

The phenomena of eclipses and occultations of satellites are now less often seen; only nineteen of them can be seen during June.

Saturn.

Saturn rises south of east on the 1st at 10h. 50m. P. M., and sets at 8h. 19m. the next morning. It souths at 3h. 35m. in the morning at an altitude of only about 28°. It is near the star π *Capricorni*.

On the 30th Saturn rises at 8h. 52m. P. M., and sets at 4h. 22m. A. M. It is then on the meridian at 1h. 35m. in the morning.

Uranus.

Uranus is still among the stars of *Gemini*, and passes the meridian now too early for observation, at 3h. 40m. on the 1st of June, setting at 10h. 56m. P. M.

On the 30th it sets at 9h. 6m. P. M., so that no good observations may be made upon it.

Neptune.

For a sight of Neptune a good telescope is always necessary, and in June it rises in the morning and sets early in the afternoon; on the 1st at 3h. 37m., and on the 30th at 1h. 46m., so that it is above the horizon, for the most of its diurnal course, in the day time.

Spots on the Sun.

At this time (May 18th) the sun is unusually free from spots, more so than for many months; with a glass of low power not a spot can be found.

Meteors.

Meteors were reported on the evenings of April 3, 24, 25, 27, 28, and 30; they were more frequent on the 30th than on any other evening.

Eclipses and Occultations.

On the 5th of May the moon occulted or seemed to pass over a small star, *s Leonis*.

On the 12th, in the morning, the moon was eclipsed, but it had set in our longitude before the dark shadow came over its face. The dimming of the surface of the moon just before its setting showed that it had passed into the faint shadow known as the penumbra.

Auroras.

Several students report that auroral streamers were observed on the evening of May 15th from 8h. 30m. to 9h. 30m. P. M., and at 8h. 45m. an auroral belt was formed, passing through the zenith, its northern edge being 15° south of α *Lyræ* and its southern edge 8° north of Jupiter. This belt was seen for only a few minutes.

Thermometer.

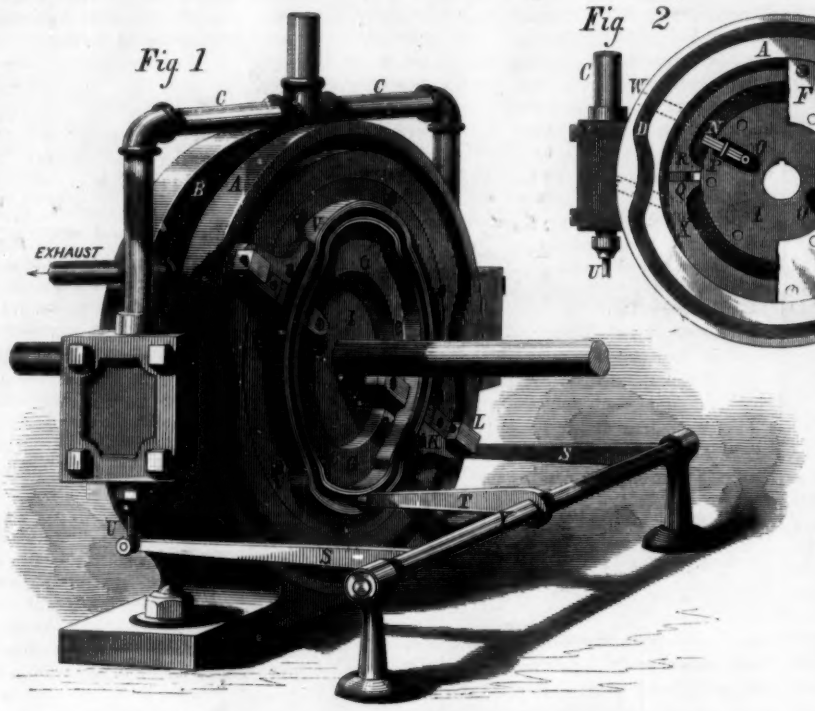
Up to this date (May 18) the thermometer has only once been recorded as high as 70 at 2 P. M. This was on the 5th of May.

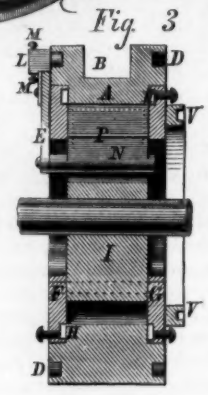
A SEMI-MONTHLY scientific periodical in Turkish is about to be brought out in Constantinople. It is called the *Dolab*, which is, in English, the *Repository*.

IMPROVED ROTARY STEAM ENGINE.

The principal feature of the invention herewith illustrated consists in a rock shaft which is driven by a cam on the face of the rotating part of the engine, so as to operate a cut-off on both steam induction pipes, in combination with internal cut-offs and slides. By this means it is claimed that the steam has a more direct application to the rotating center or cylinder, and that the mechanism is actuated with regularity and reduced friction.

Our engravings present a perspective view, Fig. 1; a front elevation, with parts broken away to show interior arrangements, Fig. 2; and a vertical cross section, Fig. 3.





INMAN'S ROTARY STEAM ENGINE.

In the external rim, A, of the engine, is made a recess, B, for convenience in attaching the steam pipes, C C; also flanges at the sides of the recess with cam grooves, D D, for imparting reciprocating motion to slides, E E. In the inner angles of the rim, A, are formed rabbets to receive face plates, F G, on either side of the machine. In these plates are arranged packing rings, H, Fig. 3, secured by springs and set screws, the latter passing through the plates and adjusted from the outside. Between the plates, F and G, and fastened thereto by bolts, is a disk, I; the rotating parts, F G and I, being thus held together in connection with the rim, A, in position to receive steam. On the back of the engine are reciprocating slides, E E, which operate in suitable guides, J, the latter being fastened to the plate, F. To prevent these slides from springing to one side when passing the cams in grooves, D, braces, K, are attached to the guides, J, and extend outwardly against the roller supports, L, thus preventing any springing of the parts so as to cause a jar. The arrangement of the roller supports is more clearly shown in Figs. 1 and 3. It consists of a box, L, secured to the slide, E, by a screw and also by a dovetail-shaped projection fitting into a slot at the extremity of the arm. To this support and revolving on a pivot secured therein by the set screws, M, is a friction roller, Fig. 3, which rotates within the groove, D. The opposite ends of the slides, E, are fastened to internal cut-offs, N, by screws, so that the latter are thereby operated. To allow of their motion, openings, O O, are made through the shaft cylinder, I, the shape of which is shown in Fig. 2. It will be noticed that for the first half inch, about, into the disk, they fit around the cut-off, but afterwards are constructed larger to accommodate the packing and packing plate, P. For a like purpose, notches are made on the inner sides of the face plates, F and G.

On the inner periphery of the rim, A, are formed cut-offs, Q, provided with suitable packing, R, which presses against the shaft cylinder, I, and against the plates, F and G, lapping under the rings, H, in the latter, as indicated by the dotted lines, Fig. 3, so that the steam cannot pass through it. It is halved and lapped so as to spread apart, has a plate under the joint, and is thrown out by springs or steam, thus forming a steam-tight connection, behind which the steam cannot penetrate. The cut-offs, N, extend outwardly from the cylinder, I, to the internal periphery of the rim, A, and form a steam-tight joint against it. The rings, H, in the face plates are cut out a little where the cut-offs would strike them, so that the latter fit closely against the rim without wearing against the packing. To prevent these rings, H, from turning, holes are made in them which slip over pins in the face plates.

Y, Fig. 1, is a rock shaft hung in bearings in the standards, as shown, and supporting arms, S S and T. The former operate the cut-offs, U; the latter, on the end of which is a friction roller, is moved by a cam groove, V, in such a manner as to give the proper motion to the arms, S S, in order to open and close said cut-offs, U, at the time the cut-offs, N, are passing the projecting packing, R. By this means no steam is used while the cut-offs, N, are passing from the exhaust, W, to the induction ports, X, shown in dotted lines in Fig. 2.

The operation of the machine may be briefly described as follows: Steam is admitted at the pipe, C, through ports, X, and escapes through ports, W; striking the cut-offs, N, just as they come up tight against the external rim, it carries them around to the cut-offs, Q, at which points the former are drawn in by the slides, E, and cam grooves, D, while at the same time the rock shaft is set in motion, as above explained, by the cam groove, V. The exhaust is operated so as not to have a vacuum ahead of the slides, N, after they pass the exhaust port. The rim is cut out so as to let the steam ahead of the internal cut-offs, N, while exhausting and while the latter are passing the cut-offs, Q, on the inner periphery of the rim.

The advantages claimed are that the machine works by the expansion of the steam, which can be cut off at any point; it is evenly balanced, steam being let in at both sides at the same time; and it has a regular motion, and can be driven at a high rate of speed. The mechanism, though apparently somewhat complex, is simple, and not liable to get out of repair.

Patented February 25, 1873. For further particulars regarding sale of rights, etc., address the inventor, Mr. Charles Inman, Hope, Midland county, Mich.

FEED AND FILTER FOR STEAM BOILERS.

The invention represented in the accompanying engraving is an apparatus for supplying steam boilers with purified feed water, thereby preventing the formation of sediment and incrustation. The device consists of the tanks, A, part of which is broken away to exhibit the internal arrangements, into which water is conducted by the pipe, B. At the bottom is a bent pipe, C, extending from the engine and serving to heat the contents. For a similar purpose another pipe, D, leads directly from the boiler to the lower part of the tank to admit steam into the same. E is a vertical shaft, actuated by a crank handle shown above, and carrying at its lower end a horizontal rod, F. G is a pipe extending from the tank, or from both reservoirs where two are employed, as represented in the engraving, into an intermediate vessel. That part of the tube, G, which is within the tank, A, is provided at H with a section of india rubber or other material, so as to be flexible. At I, floats are attached to the extremity of the pipe, holding the same elevated in the feed water, a short distance below its surface, at whatever hight the water may stand in the tank.

FEED AND FILTER FOR STEAM BOILERS.

After the feed water has been received in the reservoir, it is boiled by the steam from the boiler, so as to cause the settlement of its suspended impurities. A supply from the pure upper portion, through the always elevated end of the pipe, G, is then drawn off and either carried directly to the boiler or else into the lower receiving tank, as represented, so that any impure matter which may still remain may be deposited. Chemicals of suitable kind may be added to the water in the tank, A, to cause the precipitation of foreign substances, if the boiling alone should not produce the desired effect. By means of the shaft, E, and stirring device, F, by revolving the former the deposited sediment may be agitated previous to discharging it, so cleaning out the tank through the opening, J.

This plan contemplates tanks the capacity of which is more than sufficient for, say, twenty-four hours consumption of water, thereby giving the impurities in the upper receptacle time to settle before the water is discharged into the lower vessel, from which the boiler is supplied. Patented through the Scientific American Patent Agency, April 1, 1873. For further information address the inventor, Mr. John G. Fulton, Toledo, Ohio.

Trade Marks.

"Every person or firm doing business, no matter of what kind or nature, so long as it is honorable, should have a trade mark. It serves as an advertisement, and the first mere nominal cost is a trifle. Yet in a year's business the same amount of circular advertising would cost hundreds of dollars. The trade mark is a distinction which cannot be imitated, as the law protects it. Americans, who excel in the manufacture of certain classes of goods, and place their goods in European markets, soon discover that they are not only in competition with the best makers of the same line of goods, but find that their trade mark protects them from imitation and counterfeit. Ingenuity can be called into exercise by the use of trade marks. Some use an almost indescribable monogram, and others eccentric or unique ones, but the most appropriate is the concentration of aptitude for the especial business in which parties are engaged. If a pyrotechnist, he would not use for a trade mark a fire engine engaged in putting out the flames of a building. There should be an eternal fitness of things. There are many people engaged in the same business, yet it would not be at all difficult to have an especial originality in their designs. Let manufacturers put a trade mark on all their productions, and let dealers do the same to all the wares they send out. It is a protection to the former, and of vast business benefit to the other."

[The editor of the *Advertiser's Gazette*, from which the above is taken, should have added that it is important that trade marks be registered at Washington. The Government fee is $25. Full particulars may be had by addressing the publishers of this paper.—EDS.]

The Wonders of the Deep.

During the recent passage of the British exploring ship Challenger from England to the West Indies, the sounding line and dredge were kept constantly going. The former showed that a pretty level bottom runs off from the African coast, deepening gradually to a depth of 3,125 fathoms at about one third of the way across to the West Indies. If the Alps, Mont Blanc and all, were submerged at this spot, there would still be half a mile of water above them. Five hundred miles farther west there is a comparatively shallow part, a little less than two miles in depth. The water then deepens again to three miles, which continues close over to the West Indies. At the deepest spots both on the east and west side of the Atlantic, the dredge brought up a quantity of dark red clay, which contained just sufficient animal life to prove that life exists at all depths. No difficulty was experienced in obtaining these deep sea dredgings, and it was merely a question of patience, each haul occupying twelve hours. In depths over two miles little has been found, but that little was totally new. One of the lions of the cruise is a new species of lobster perfectly transparent. Not content with obtaining animals with eyes so fully developed that the body may be said to be an appendage, a new crustacean has now been dredged up, in which the body has cut itself clear of the eyes altogether, and the animal is totally blind. It has no eyes, or even the trace of an eye. To make up for its deficiency Nature has supplied it with the most beautifully developed, delicate lady-like claws, if one may use the term, it is possible to conceive. Nearer the West Indies, in a depth of only half a mile, some similar creatures were brought up, and here the claws, longer than the body, are armed throughout with a multitude of spike-like teeth, looking more like a crocodile's jaw than anything else. At a short distance from Teneriffe, in a depth of a mile and a half, a rich and extremely interesting haul of sponges and coral was obtained, but the latter was unfortunately dead.

COUNTRY COTTAGE AND STABLE.

We complete the series of designs which we recently published, extracted from *Downing's Cottage Residences*, published by John Wiley & Son, New York city, with the accompanying engravings of a very tasteful and elegant country dwelling (Figs. 126 and 127), and of a neat and commodious stable (Figs. 99 and 100), which might be erected in connection therewith. The material for the construction of the cottage is brick, and a very picturesque style of architecture has been followed, with which the interior fittings of the house are designed to harmonize.

There is a large front porch leading to the vestibule, which is separated from the hall by an ornamental screen of carved chestnut. The flooring is of encaustic tiles of ornamental pattern. The main hall is large and roomy, and communicates at the right with a library, which opens into a small conservatory or flower alcove. The parlor immediately in rear of this apartment is a spacious room, and fronts upon a broad veranda. The dining room is supplemented by a butler's pantry, and contains several closets and other conveniences. This story is ten feet high and finished in chestnut. The basement is similarly divided, the partitions being of brick to insure a strong support to the floor above. The kitchen is under the dining room and has three large windows.

The second story is finished in chestnut and pine, and comprises three square chambers and a small servants' room. The hight from floor to ceiling is ten feet. There are open fire places in all the rooms, and provision is made for a portable furnace in the cellar.

In constructing the house, blue stone trimmings, neatly dressed, may be tastefully employed, and the bricks for the outside facings should be selected for uniformity of tint and sharpness of outline, and laid in dark colored mortar. The roofs are slated and surmounted by ornamental cresting of cast iron. The estimated cost is about $8,000, but it is probable that, near cities or in localities where the ruling rates of building materials are high, this sum would be somewhat exceeded.

The stable is of quite ornamental form, and is designed to be built upon sloping ground. It has beneath it another story for farm horses, cows, cellar for roots, etc. (not shown in the elevation), making altogether a very complete building. It is constructed of sound timber, sheathed with matched pine plank, battened, and the whole filled in with brick. The walls of the cellar story are blue stone, laid in mortar. The plan shows a carriage roo n, double floored and ceiled all around, with a harness room and separately inclosed stairway in the rear. On the left is a tool room, workshop, etc.; on the right a stable with stalls for four horses. Over the whole is a large loft for hay, with mouths in the floor to feed the racks below. The cost would average from $2,500 to $2,800, depending upon expense of labor and material.

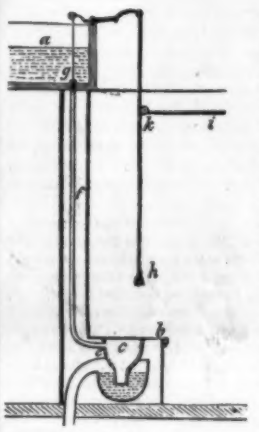


FIG. 46.

In connection with our present subject, we subjoin an engraving of a good and cheap arrangement of water closet (Fig. 46), which may be easily introduced into any dwelling, thus avoiding the necessity of the ordinary unsightly and disagreeable edifices in the rear. The cistern, *a*, may be at any distance from the seat, *b*, provided it be on a higher level by four or five feet. The basin, *c*, is an inverted hollow cone, and communicates with a closed leaden vessel, *d*, called the smell trap. In the side of *c*, at *e*, is a pipe, *f*, leading to the cistern, at its entrance into which is a close fitting valve, *g*. When it is desired to allow the water to rush down into the basin, it is only necessary to pull the string, *h*, which, if the cistern be at a distance, may pass over several pulleys. In order to insure the descent of a quantity of water to the basin every time it has been used, a cord, *i*, may be joined to *h*, and passed over a pulley, *k*. The end is then fastened to the upper part of the door of the closet at such a distance as will suffice to lift up the valve, *g*. The door should have a spring to shut it, lest it be left open by neglect. The waste pipe from the water closet should leave the house by a properly fitted underground drain, and should either terminate in a covered drain or sewer at a considerable distance or in a well or cistern for liquid manure, the contents of which may be turned to valuable account.

THE POSITION OF A HOUSE.

Houses on streets running north and south are far preferable to those located on streets going east and west, in a sanitary estimate. In the first, here at the north of the equator, the sun shines brilliantly in the forenoon on the front, and with nearly equal force in the afternoon on the rear. Thus dampness is expelled, and the whole edifice is dry and far purer for its solar exposure. If a house is on an east and west street, those fronting north are decidedly the best for a residence, because the sun's action on the yard, the kitchen, and usual regions of neglected accumulations, purifies and modifies the humid atmosphere that is sure to predominate in yards and the back part of houses whose rear is north of the street. Thus circumstanced, the back rooms are never so pleasant, cheerful or economically warmed in winter, as when on the south side. Opening on the street, the front of such gets both light and air by reason of the frequent swing of the front door.

Manufacture of Putty.

One of the largest manufactories of this substance is that of Raynolds & Co., at Bergen Point, N. J., and the process is thus described by a correspondent of the New York *Times:*

Only whiting and linseed oil are used; no barytes or other adulteration are introduced. The whiting and linseed oil are roughly mixed in wooden troughs—two gallons of oil to 100 pounds of whiting—and are then shoveled into the mills, 750 pounds forming a batch. The chaser, which is an enormous iron wheel revolving horizontally in a pan like a fountain basin, is at once set in motion. It gradually works the whiting and oil together, two scrapers turning the mass up into a ridge in the center, on the principle of a plow share. In twenty minutes the putty is thoroughly kneaded into a pliable and lubricated mass, and is ready for packing. The daily product of the two mills is about 12,000 pounds. The putty is packed in ox bladders, tubs and barrels; about 10 pounds to a bladder, 100 pounds to a tub, and 720 pounds to a barrel. It is amusing to watch the workmen stuffing the bladders. They seize a lump of putty and stuff it into the bladder with their thumbs with astonishing rapidity. A bladder is filled and tied in about ten seconds. It rather reminds one of sausage making, in our grandmothers' days. The following figures will give some idea of the extent of this business: Last year the firm packed 2,027,962 pounds of putty in tubs and barrels, and 696,683 pounds in bladders, the latter using up no less than 62,116 bladders.

A PICTURESQUE BRICK COTTAGE.

Fig. 126.

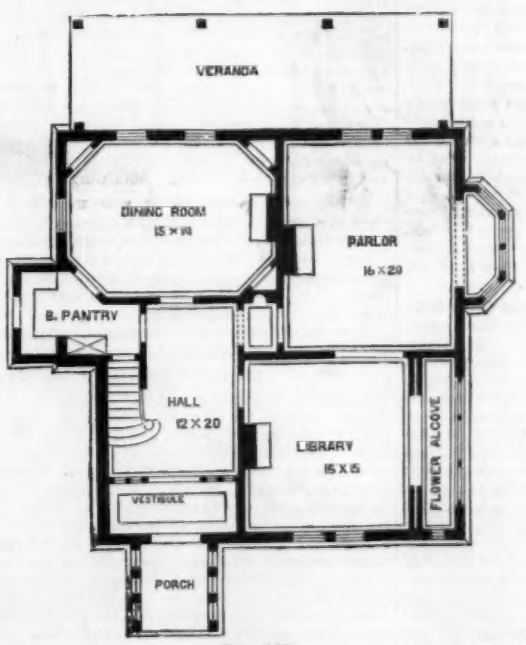


Fig. 127.

A CARRIAGE HOUSE AND STABLE IN THE RUSTIC POINTED STYLE.

Fig. 99.

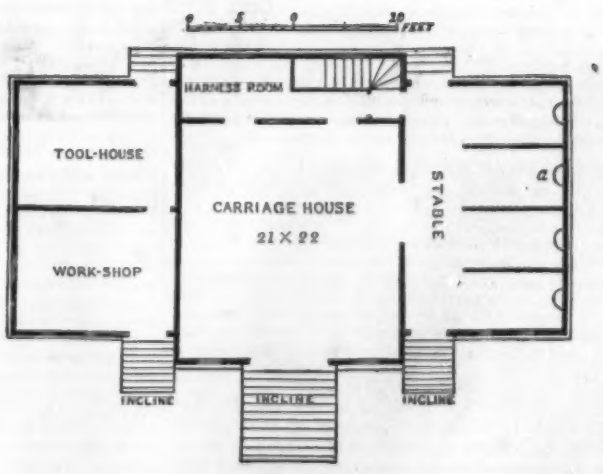
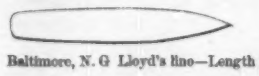


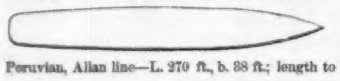
Fig. 100.

The Proportions of Ocean Steamers.

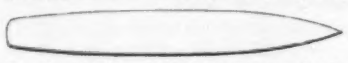
In publishing (on page 309 of our current volume) Mr. W. Cunningham's letter on the proportions of ocean steamers, an error in the engraving gave an incorrect impression as to the relative widths of the vessels. We therefore reprint the dimensions, with new illustrations accurately drawn to scale.



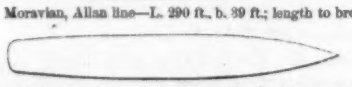
Baltimore, N. G Lloyd's line—Length 185 ft., beam 29 ft.; length to breadth, 6·38.



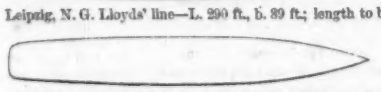
Peruvian, Allan line—L. 270 ft., b. 38 ft.; length to breadth, 7·11.



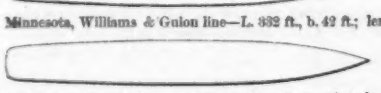
Moravian, Allan line—L. 290 ft., b. 39 ft.; length to breadth. 7·44.



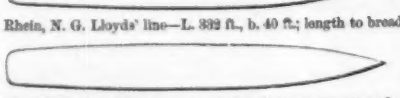
Leipzig, N. G. Lloyds' line—L. 290 ft., b. 39 ft.; length to breadth, 7·44.



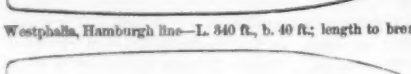
Minnesota, Williams & Guion line—L. 332 ft., b. 42 ft.; length to breadth, 7·90.



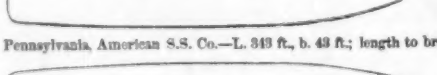
Rhein, N. G. Lloyds' line—L. 332 ft., b. 40 ft.; length to breadth, 8·30.



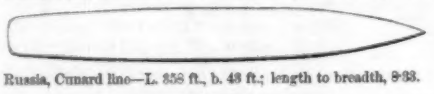
Westphalia, Hamburgh line—L. 340 ft., b. 40 ft.; length to breadth, 8·50.



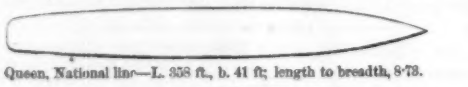
Pennsylvania, American S.S. Co.—L. 349 ft., b. 49 ft.; length to breadth, 7·91.



Russia, Cunard line—L. 358 ft., b. 43 ft.; length to breadth, 8·33.

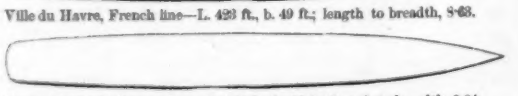


Queen, National line—L. 358 ft., b. 41 ft; length to breadth, 8·73.



Ville du Havre, French line—L. 423 ft., b. 49 ft.; length to breadth, 8·63.

City of Montreal, Inman line—L. 433 ft., b. 44 ft.; length to breadth, 9·84.



Atlantic, White Star line—L. 435 ft. b. 41 ft.; length to breadth, 10·61.

A New Window Awning.

Mr. George W. Gerau, of No. 359 Fulton street, Brooklyn, N.Y., has recently patented, through the Scientific American Patent Agency, an improved window awning, which is so arranged as to afford shade and at the same time to create a draft, thus ensuring the thorough ventilation of the apartment to which it may be adjusted. The invention consists in making the wings of the awning detachable, so that, by means of suitably contrived braces, either or both sides may be pushed outward and held open. When one wing is thus arranged, the other is stretched across the awning diagonally and fastened to the window frame, thus forming a clear passage for the air into the room. The device can be readily applied to old awnings and will doubtless prove a convenient and pleasant addition to our means of keeping cool during the coming hot weather.

NEW BOOKS AND PUBLICATIONS.

FIFTH ANNUAL REPORT ON THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE STATE OF MISSOURI, made to the State Board of Agriculture. By Charles V. Riley, State Entomologist. Jefferson City, Mo.: Regan & Carter.

This is not the first time we have had occasion to commend the liberality of the State of Missouri in engaging the distinguished scientist, to whom we are indebted for this valuable report, to examine and describe the insect tribes of its rapidly advancing province. As a trustworthy and instructive volume on a most interesting branch of science, this report will be highly valued by all who will obtain and read it.

THE GERMAN PHARMACOPŒIA: Translated from the German and carefully compared with the Original Latin Text. By C. L. Lochman. Carlisle, Pa.: C. L. Lockman & Co.

We have received advance sheets of this work, which show at once the ability and accuracy with which it has been translated. The supremacy of German scientists in all branches of chemistry is everywhere acknowledged; and this text book will as found welcome to the libraries of our students and in our druggists' laboratories. Mr. Lochman has only recently contributed valuable technical information to our columns.

THE MINERAL SPRINGS OF NORTH AMERICA: How to reach and how to use them. By J. J. Moorman, M.D. Philadelphia: J. B. Lippincott & Co.

Dr. Moorman gives to the public in this timely volume, the result of a long experience in the investigation of the nature and medicinal applicability of mineral waters. He tells, in a clear and concise manner, to those desirous of regaining health through the healing fountains scattered over the country, just what places should be visited for the benefit of certain disorders, how the medicine should be used, its nature, and in fact about everything in which one going to a watering place for a purpose other than to follow the dictates of fashion would care to be posted. The work contains several illustrations of popular resorts with instructions how to get there, and also maps of the well known sulphur springs of Virginia.

THE BATH: Its History and Uses in Health and Disease. By R. T. Trall, M.D. 25 cents, paper; 50 cents, cloth. New York: S. R. Wells, 389 Broadway.

This is a neat little volume, in which the various forms and uses of baths are pleasantly described, especially with reference to hydropathy. The Turkish and Russian baths are, however, dismissed in one paragraph, and that is selected from the writings of a singularly prejudiced English physician. The text is liberally illustrated with engravings.

CONSUMPTION AND ITS TREATMENT IN ALL ITS FORMS. By Dr. Carl Both. Boston: Alexander Moore. Boston and New York: Lee & Shepard. London: Trübner & Co.

This book is a valuable contribution to medical literature, being the work of an able and learned writer. It contains much interesting physiological information which will be of value to the general reader as well as to the physician.

THE SCIENCE OF HEALTH: Devoted to Health on Hygienic Principles. $2 a year. New York: S. R. Wells, 389 Broadway. Also, from the same publisher:

PHRENOLOGICAL JOURNAL AND LIFE ILLUSTRATED.

These two magazines are well known to our readers, and are mentioned here on account of their sustained and uniform excellence. They contain much varied matter, some of which is well selected from the current literature of both hemispheres.

FORMULAS AND TABLES FOR ARCHITECTS AND ENGINEERS in Calculating the Strains and Capacity of Structures in Iron and Wood. By F. Schumann, C. E. Illustrated. Pocket size in flexible covers. Washington: Warren Choate & Co.

We need add no further words of recommendation of this convenient little volume than to say that it is a compendium of the formulas of the celebrated works of Weisbach, Rankine and other eminent authors, simplified and reduced to practical form. The book is designed for ready reference—a pocket guide, in fact—and hence space is economized throughout, though an incredible amount of information necessary in the daily routine of the engineer and architect is comprised within its covers. The contents include formulas for strength of material, strains, loads and all general calculations of similar character. The volume is illustrated with three hundred original diagrams, elucidating the text. The author, we think, in thus simplifying reliable formulas so that they may readily supplant the rough and empirical rules too often carelessly used, has done a good work which we do not doubt will meet with a well deserved appreciation from all members of the profession.

PATENT OFFICE DECISIONS.

PATENT FISHES.—THE AMERICAN SARDINE COMPANY.—APPEAL.

LEGGETT, *Commissioner:*

Applicants seek to have the words "American Sardines" registered as their trade mark, to be applied upon boxes containing a preparation of fish of the herring family, to which Mediterranean sardines belong, known as the "Menhaden," or "Moss Bunker." These fish, it is alleged, are of larger size than sardines, and have not heretofore been used as an article of food, owing to their numerous fine bones. Applicants set forth that they have been accustomed to treat them by a certain patented process, whereby their bones become softened, and they are converted into a valuable article of food. As thus prepared they have packed them in suitable boxes as sardines are packed, placed them upon the market, and adopted the name or label "American Sardines" for them, by which it is alleged they are known to the trade, and appropriately designated, as to source or origin, as the product or article prepared and sold by the American Sardine Company. This name, it is said, is neither "the true denomination of the goods," nor of the fish themselves before their preparation, but is merely an arbitrary mark calculated to designate this manufacture as a product furnished the trade by this company, and is no further descriptive of the product than merely as such a designation of it. This is all of the substance of applicants' arguments.

It is acknowledged that the word "sardines" is not intended to truly indicate, and does not truly indicate, the contents of the boxes—the kind of fish they contain. That word, then, is obviously calculated to deceive when placed on a box of applicants' prepared fish as a label. But the word "American" employed with it is supposed to obviate this objection. This word, however, is, from the nature of the case, merely descriptive. It is in common use to distinguish all sorts of products made in this country from foreign products. It cannot be divested of that significance when placed upon an article displayed for sale. It does not diminish the deception which the false name applied to the boxes of fish is naturally calculated to convey. It rather aids that deception, for in fact there are no American sardines. The designation of the boxes of fish as "American Sardines," therefore, is but the adoption of a false name for them. If there were any American sardines known, or if any should be discovered in the waters of any of our coasts, American sardines would be their true name, and for that reason could not constitute a trade mark to designate them.

These words have not the virtue of a new name, a "coined" word, which, like the word "cocoaine," for instance, may be a legal trade mark. Especially is this true when they are applied as a label upon boxes of fish like ordinary sardine boxes. They are simply a misnomer in such a use, calculated to produce a false impression. It is immaterial that, on account of their large size, an examination of the fish will readily undeceive the purchaser. The effect of the mark itself is alone to be taken into consideration. If that is a false mark merely, and likely to be deceptive, it is not a legal trade mark and ought not to be registered. Such I regard it. The decision of the Examiner of Trade Marks is sustained.

Recent American and Foreign Patents.

Improved Work Stand.

Chauncey S. Caple, Frankfort, N. Y., assignor to himself and William Gates, of same place.—This invention consists in the improvement of work stands. The center piece is a casting of metal with four vertical holes arranged around the vertical center in which the pivot pin of the table top works. In these holes are introduced the upper ends of the legs. A ring or dish connects the legs at the middle, and has a recess in the under side, and as many radial holes extending from the periphery to it as there are legs, and the legs, being notched, are fitted in corresponding notches in the disk, and secured by bolts inserted in the said holes, and fastened by keys driven into the ends projecting into the recess, and having holes provided for said keys. A spool stand is fastened detachably to the top of the table center. For so fastening it, and having it at the same time so that it can be readily detached, a recess is arranged in the bottom of the disk of metal, and a hole near the periphery large enough to admit the head of a pin. From this hole the slot, as wide as the shank of a pin, extends to the center. The pin is fitted into the vertical hole in the center of the table, and has a coiled spring fitted in the bearing against the table top so as to constantly press it down. A lever is connected at one end to the pin at its lower end, and extends towards the periphery of the table top as far as the opening, when the finger can be applied to push it down and raise the pin when the cover of the opening is removed. The pin head, being suitably shaped and held in it by the pressure of the spring, holds the stand in place so that it cannot be detached until the pin is raised by the lever. To detach the stand, the head of the pin is raised out of the countersunk recess, and the stand moved sidewise till the hole comes to the pin, when it can be lifted off.

Improved Milk Cooler.

William Hodgdon, North Craftsbury, Vt.—This invention consists of a large water pan divided into compartments, with a separate water supply pipe for each and a discharge pipe connection of each with a main waste water pipe, arranged for filling and regulating the temperature in each independently. A separate milk pan is arranged for each compartment, each pan having a discharge pipe for milk, all in a convenient way for treating the milk of each milking independently, so that the treatment can be varied as to the temperature, as required during the time it has to be cooled. The arrangement is also designed to facilitate the removal of the milk pans readily for painting the bottoms, which has to be done frequently to protect them from corrosion; also for cleansing the large pan.

Improved Combined Stop Cock, Check Valve, and Blow Off.

Elbridge G. Cushing, Oswego, N. Y.—This invention consists in a combined stop cock, check valve, and blow off cock. The shell of an ordinary stop cock is used with the inlet pipe connection arranged near the bottom, and the outlet pipes near the top. The hollow plug cock has an opening into the lower part coinciding with the inlet pipe, and two others in the upper part coinciding with the outlet pipes. It also has a diaphragm between the said openings, dividing the hollow space into two chambers. A passage is formed through this diaphragm, and a valve seat arranged on the upper side of it, on which a check valve is fitted to close downward. This valve has a tubular extension upon the upper side, in which the smooth part of the stem fits in such manner as to form a guide for the valve. This stem screws out and in through the top of the plug, having a hand wheel on the top, and it has a shoulder on the lower end to be forced down on the top of the valve to fasten it closed. This shoulder will also limit the amount of the opening of the valve in case it be desirable to do so. One pipe connection is to be connected with the boiler, and the other to be used for the blow off. When the water is to be forced into the boiler, the plug will be adjusted, by which the passage is opened from the inlet pipe up through the valve and pipe into the boiler, and the escape is closed; but when the boiler is to be blown off, the position of the parts may be suitably altered.

Improved Adjustable Sewing Machine Chair.

Franklin Chichester, Milwaukee, Wis.—This invention has for its object to furnish an improved chair for the use of sewing machine operators, which shall be so constructed that it may be readily adjusted as the convenience of the operator may be required, and the back of which will automatically adjust itself to the back of the operator. The pedestal is secured to the center of a cross bar, the ends of which have downwardly projecting arms formed upon them, to which are attached pivots. To the outer ends of the pivots are pivoted plates attached to the side edges of the chair seat. The upper middle part of the rear arms of the plates is cut away so that its lower edge may be about upon a level with the top of the cross bar, and in said edge are formed notches to receive the latch. The latch may be drawn out to enter the notches of the plate, and pushed in to release said plate. It is kept from lateral movement by guide lugs, and is locked in either position by a projection formed upon said cross bar which enters notches on the under side. Springs are connected with the lower side of the forward part of the chair seat. By this construction the chair seat is held securely in place when adjusted by the latches, the springs simply making the adjustment more easy. The chair may be used as a rocking or oscillating chair. Springs are attached to the connecting bars, which pass up through slots between the plates and the edges of the chair seat, and their upper ends support the forward ends of the arms. Latches are pivoted to these bars which catch upon notches formed in the upper edges of the forward parts of the plates. The lower edge of the lower part of the chair back is hinged so that it may be adjusted in any desired position by adjusting the arms by by means of the bars and latches, the springs making the adjustment more easy. The lower part of the back consists of a cross bar and two side bars. A coiled spring is so arranged as to tend to throw the lower end of the upper part of the back forward against the back of the person sitting in the chair.

Improved Carriage Axle Box.

Joseph Jones, James Dunkerley, and Joseph Dunkerley, Paterson, N. J.—This invention has for its object to furnish an improved axle arm and axle box so constructed as to prevent the entrance of mud and sand at the inner end of the hub, to hold the axle box securely in place upon the axle arm, and to enable the axle to be conveniently kept thoroughly lubricated. The axle box fits and revolves upon the axle, and its inner end is kept in place by a collar formed upon the said axle. The outer side of the collar is recessed to receive the inner end of the box, which end is allowed to project a little beyond the inner end of the hub for this purpose, so that mud and sand may be wholly prevented from working in at the end of the hub. The inner end of the box is also reamed out and enlarged to form a shoulder to rest against a shoulder formed upon the axle to relieve the collar from having to support the whole inward pressure of the wheel. In the outer end of the axle is formed a screw hole into which is screwed a screw, the head of which is made of a little larger diameter than the axle, so as to rest against a shoulder. The screw projects beyond its head, and the projecting part is perforated longitudinally, and from the inner end of said perforation an inclined hole is formed, leading out at the inner side of the head of said screw. A screw cap screws into the recessed outer end of the box, and is flanged to overlap the outer end of the hub. The cap is made hollow to serve as an oil chamber, the inner wall of said cap being perforated to receive the perforated end of the screw, so that the oil from said chamber may pass through the perforations of the screw to the axle arm, which is grooved longitudinally to conduct the oil to the inner part of said axle, and thus lubricate its entire surface. The box has lugs formed upon its outer surface to prevent it from turning in the hub.

Improved Saw Set.

Cyrus E. Grandy, Stafford Springs, Conn., assignor to himself, Ziba B. Grandy, and William D. Heald, of same place.—This invention consists in the mode of combining certain instrumentalities to form a saw set for band saws. The stock to which the parts of the saw set are attached forms a handle and base of the instrument. The die bar is hinged to the end of the stock and carries the die. Power is applied by means of a cam lever, confined to the end of the die bar by means of an adjustable link. The back motion of the die bar is produced by a spring. The spring keeps the end of the die bar in close contact with the cam end of the lever, and the power is applied by simply raising the end or operating the lever. The purchase thus obtained is very great, and the power is applied gradually. A guide slides on the stock so that it can be adjusted to the width of the saw. This guide is used in setting band and gig saws. A loose adjustable pawl is attached to the stock, which in setting band saws engages with the teeth, and thereby governs the position of the teeth in relation to the dies. Allowing the teeth of the saw to be of uniform size a movement of the pawl to each alternate tooth will bring the proper tooth to be set in contact with the die.

Improved "Knock Down" Chair.

Charles R. Long, Louisville, Ky., assignor to Long & Brothers, of same place.—For making knock-down chairs, for convenience of packing them in parts for shipment and storage and then setting them up readily, the inventor proposes to bevel the ends of the back rail of the seat frame, and form a half round notch in each end fitting the tenon of the side stretchers, and arrange them so that said tenons extend through and by said notches to enter the holes for them in the posts of the back of the chair, in which oblique notches are made for the ends of the back rail coinciding with the holes for the tenons of the side stretchers. When the seat frame is put together, and the seat bottom woven in it, the back rail and the side stretchers can be put together with the back posts by entering them in the notches and holes together from the front. The back rail and side stretchers are fitted together and glued, and the side and front stretchers connected to the front posts in the ordinary way. The seat bottom, when woven on, forms an L-shaped structure which nests together compactly for shipping. The back posts are connected together by the back cross pieces, and thus are in convenient shape for packing compactly.

Improved Weather Strip.

Jerome Bacon and Gilbert Bacon, Medina, Wis.—The object of this invention is to furnish a weather strip for doors. Triangular shaped pieces of wood are connected together by butt hinges and by a spring, a piece of sheet rubber covering them. This rubber extends a little above the upper piece and considerably below the lower piece. Metallic strips, by means of which the rubber is fastened, are placed even with the upper and the lower edges of the wood. The upper piece is screwed to the outside of the door. A lug is made in the door sill or in the jamb casing of the door, and a hook or projection is attached to the end of the other part of the door strip. When the door is closed the hook catches on the lug and draws the part down on the sill, thus making a tight joint under the door. When the door is opened the spring forces the lower part upward so that it will swing clear of all obstructions.

Improved Washing Machine.

Nelson O. Wilcox, Omaha, Neb.—The object of this invention is to provide convenient means for washing clothes, and it consists in an extension be for adapting it and fastening it to tubs of different diameter, and in a corrugated spring roller, which is placed directly over and nearly in contact with the bed rollers. It will be understood that when the clothes are made to pass between the two rollers the corrugated roller must be forced upward, but that motion will be resisted by the springs, and consequently the clothes will be squeezed by a force proportioned to the strength of the springs.

Improved Thrashing Machine.

Charles M. Powers, Ridgewood, N. J.—The object of this invention is to furnish a machine for thrashing and cleaning grain, which may be used either by hand or motive power, and which shall effectually beat out the grain without injuring the straw. The frame of the machine is of rectangular form and elevated to a convenient hight. In the middle and on a line with the platform is the corrugated and perforated bed. The material to be thrashed is laid upon an endless apron, which carries it along over the bed, where the grain is beaten out. The straw is then carried along by another apron and discharged from the tail of the machine. While the grain is passing over the bed it is subjected to the action of the beater, which is composed of a series of bars. The thrashing is effected by a rapid up and down motion of the beater, the bars of which are brought in contact, or nearly in contact, with the bed at each stroke. The motion of the beater is produced by means of the pin wheel on the driving shaft. The grain and chaff fall upon sieves as they pass through the bed. These sieves are given a vibrating motion by means of the ordinary fanning mill device.

Improved Lifting Jack.

William M. Doty, New York city.—The object of this invention is to improve, simplify, and cheapen apparatus for raising carriages and wagons, and for all similar uses. The back edge of the lifting bar is provided with ratchet teeth with which the ratchet link is made to engage for lifting the link, it being loosely attached to the short end of the lever. The link works loosely on the bar, and drops by its own gravity when the long end of the lever is received. When the link engages with a tooth of the bar its outer end binds or gripes the other edge of the bar, the link being a gripe as well as a ratchet pawl. By means of the link the bar can be raised eight or ten inches, more or less. The weight of the lifting bar is supported by means of an adjustable friction spring, which is made to bear against its side. This spring consists of a piece of rubber tubing on a wood screw. By turning the screw the rubber tube is expanded or contracted, and the friction on the bar is increased or diminished, as may be required. Lifters on the bar are arranged so as to be nearly over the center of gravity when either one of them is employed. This adapts the jack for all kinds of vehicles, the axles of which vary from one to two feet, or more, in hight from the ground.

Improved Wood Finishing Compound or Oil.

Frederick Webster, Brooklyn, N. Y.—This invention has for its object to furnish an improved oil designed more especially for black walnut, real or imitation, but applicable to other woods, which, when applied to new work, brings out the natural colors, removes the roughness, and gives a smooth finish, and which, when applied to old work, restores its colors to their former brightness. The invention consists in an improved finishing oil, prepared of raw linseed oil, boiled linseed oil, spirits of turpentine, and liquid paint dryer. Beeswax is put into the mixture which is then thoroughly stirred, poured all at once or a part a time into some suitable vessel, and heated sufficiently to wholly melt the wax. The oil is now ready for use and may be applied with a brush. When applied to solid walnut it should be allowed to stand twenty minutes and then rubbed in with a woolen cloth in the ordinary way.

Improved Scroll Saw.

Hezekiah B. Smith, Smithville, N. J.—This invention has for its object to furnish an improved jig saw so constructed that the work and saw may be rotated by turning the table so as to keep the work from coming in contact with the framework of the machine, or with other obstructions, without the necessity of stopping the saw. Upon the driving shaft is formed a cam to receive a rod, the upper and lower ends of which are pivoted to the arms of elbow levers, which are pivoted at their angles to the frame. To the other arms of the elbow levers are attached straps which pass around guide rollers and are attached to the outer ends of the square sliding rods, with the inner or adjacent ends of which the ends of the saw are connected, so that the saw may be moved up and down by the revolution of the shaft. The upper guide roller is pivoted in a frame which slides up and down in ways and is connected with a lever pivoted to an arm attached to the frame, and held in place. This arrangement enables the tension of the saw to be regulated as desired. By suitable construction, by holding the work fast to the table and turning the said table in one or the other direction, the saw will be turned with it so that the work can be fed to the saw in its new direction without delay and without stopping the machine.

Improved Neck Tie.

Reginald R. Parker, Indianapolis, Ind.—The object of this invention is to improve, simplify, and cheapen neck ties; and it consists in the manner of folding the silk or goods of which the neck tie is made over the corners of the shield. The points are covered by folded down triangular pieces.

Improved Corn Sheller.

Franklin Hollen and Amos C. Holland, Marion, Ill.—This invention has for its object to furnish an improved hand corn sheller, enabling the corn to be shelled easily and rapidly. The invention consists in the shelling grate, which is formed by a number of bars fluted or concaved longitudinally upon their upper sides so that their side edges may be sharp to remove the corn from the cob. The upper end of the machine may be conveniently raised and lowered, as required. In using the sheller, the ear of corn is passed into a box and drawn across the bars of the rack, the sharp edges of which quickly remove the kernels from the cob, the box keeping the kernels from flying about, and guiding them into the bag or vessel placed to receive them.

Electric Battery.

Louis Bastet, New York city.—The invention consists in a compound of cupric salt, preferably the sulphate, and of the nitrate of soda or potash, in a solution of the same ingredients in sulphuric acid, to form a liquid compound, and in the employment of nitro-hyposulphate of sodium or potash—all for application to electric batteries.

Marine Post Office Safe and Life Preserver.

George F. Abraham, Baltimore, Md.—The invention consists in a combined post office safe and life preserver applied on board of vessels so that papers and other valuables as well as lives may be saved. It consists in providing the same with a rope and ladder, arranged so that the person in charge may always be able to reach his proper position thereon, no matter where he may be when the accident occurs. It also consists in making the preserver and safe in sections.

Improved Seed Planter.

Isaac T. Suggs, Greene Hill, Texas.—The invention consists in the improvement of seed planters. To and between the forward ends of the main frame of the machine is pivoted the rear end of a short beam, to the forward end of which the draft is applied. The beam is made thick so that two or more holes may be formed in its forward end to receive the draft clevis. By this means, by adjusting the draft clevis higher or lower, the harrow may be made to work deeper or shallower in the ground, as may be desired. To the under side of the beam is secured a small triangular or V shaped harrow, to remove clods, stalks, and other obstructions, and to loosen up the soil to better prepare it for the opener and cover.

Improved Convertible Freight Car.

Thomas Fogg, St. Mary's, Canada.—The object of this invention is to construct a railroad freight car so that it may be readily converted from an ordinary freight or box car to a car for transporting grain in bulk, provided with a spout or chute for discharging the grain. Bars are attached to the flaps, which are connected with the ends of the car by slotted plates, which allow the flaps to drop down on angular cleats on the sides of the car. When thus arranged, they present the grain for entering the end angles of the car and allow it to slide forward toward a center chute. When not in use for this purpose, they slide up in the slotted plates, where they are supported by hooks. The hinged section of the bottom is held up in a vertical position by the buttons attached to the car stanchion. The action of these buttons is limited by the angular shanks which enter the curved cavities in the side or the car. By this mode of construction it will be seen that the car may be used either for ordinary freight, as common box cars are used, or for grain in the bulk, the change from one to the other being readily and speedily made.

Improvement in Oiling Millstone Spindles.

John J. Chuob, Decatur, Ind., assignor to himself and Samuel C. Bollman, same place.—This invention has for its object to furnish an improved device for oiling spindles, by the use of which the spindle may be kept properly oiled, and which shall be convenient in use. The invention consists in the tube embedded in a channel in the leading furrow of the stationary stone, and extending from the heel or skirt to the bosom of said stone. Upon the outer part of the tube is formed a cup to receive the oil, and which is provided with a cap or cover. The outer end of the tube is provided with a cap, cork, or other stopper, to enable a wire to be inserted to clear out the tube.

Improved Mitten.

Farnam L. Oakley, New York city.—This invention consists in the manufacture of knitted mittens in flat web with the wrist and hand portion shaped exactly as demanded, and nicely formed and well fitting thumbs, conforming as nicely to the shape of the natural hand as these portions of the gloves which are made by cutting by patterns from skins or cloths, by widening the web on one or both edges as much beyond the width required for the wrist and hand as needed for the thumb, so that when the web is folded and sewn up, the thumb springs out from the side of the hand portion as it does in the natural hand and in the mittens and gloves cut out by patterns.

Combined Journal Box and Lubricator for Shafting, Axles, etc.

Joseph R. Morris, Houston, Texas.—The invention consists in combining, with a journal box of peculiar construction, an oil elevator and a device for saving, to be used over and over again, oil which would otherwise escape and be wasted.

Improved Mortising Machine.

Eugene Hammond, Cumberland, Md.—The invention consists in adjustable spring spacing gages applied in the recessed side of the carriage of a mortising machine, to regulate the distance between the mortises; also in hinged gages for end-beveled posts; also in combining with the carriage of a mortising machine, a gage dog, gage, and stop bar to regulate the length of the mortise.

Improved Gate Hinge.

Willard G. Franklin, Shelbina, Mo.—This invention has for its object to furnish improved gate hinges, which shall be so constructed that the gate may be adjusted to swing level or to incline upward as it swings back, and which will allow the forward end of the gate to be raised when desired to allow hogs or other small animals to pass through. It consists in the post piece having a screw shank, a shoulder plate, and a three hole eye plate, and the gate piece having slots and semicircular notches formed in it.

Improved Machine for Paring Horses' Hoofs.

George W. Schafer, St. Charles, Mo.—This invention relates to apparatus for facilitating the paring of horses' hoofs preparatory to shoeing. A circular piece of metal two inches in width, forming something more than a semicircle, has a bar extending from one end to the other. This circular plate corresponds with the size of the hoof, and is placed on the hoof when used. In forming the circle, the plate is made dishing so as to fit the hoof with the bar passing across the heel on a plane parallel with the bottom of the hoof. A knife blade with a double edge is fastened to the under side of the bar by a pivot bolt. The point of this knife reaches over the edge of the circle. A lever is attached to the bar by the pivot bolt, and is connected with the knife by a stud bolt. The knife is moved back and forth as the lever is moved. The edge of the circle forms a guide for paring the hoof, the edge of the knife being placed a little above the edge of the circle, but is sprung down to the edge of the circle by means of the lever, so that the portion of the hoof which protrudes will be pared even with the edge of the circle. A handle on the circle, which is grasped by the operator, allows him to counteract the force of the lever on the horse's foot.

Improved Rotary Steam Engine.

John Lucas, Hastings, Minn.—This invention relates to the class of steam engines known as "rotary," where a crank is dispensed with. The piston wheel is attached to the central driving shaft, and the pistons slide in slots in the flange of the piston wheel as that wheel revolves, moving longitudinally in the wheel, being constructed with slots through which the shaft passes. Each piston is formed of two like-shaped and equal-sized parts, which are connected by two right and left hand screw nuts. By turning these nuts the two parts of the piston can be adjusted to take up the wear and insure their working steam tight within the cylinder. A valve, having the form of a slightly obtuse angle, is pivoted at its apex equidistant between the induction ports. The end of each of its arms is made slightly convex to allow it to fit snugly against the inner periphery of the cylinder, and the outer side slightly concave, corresponding or concentric with the cylinder. The valve being in proper position to receive the impact of steam admitted by the left hand port, the steam acting on the piston projecting through the wheel on that side, causes the latter to revolve from left to right. Shutting off steam at the left hand port and admitting it at the other will cause the valve to turn on its pivot and assume the opposite position, which will effect the reversal of the wheel.

Improved Pruning Shears.

William McCray, Black Oak, Mo.—This invention has for its object to furnish an improved pruning shears. The cutting edge of the stationary blade is made with a re-entrant angle to receive and detain the limb while being cut. The edge of the movable blade is made with a rounded or convex edge to shear off the limb while detained in the angle. To the upper end of one handle is attached the end of a bar having the stationary blade formed upon its forward edge, near its upper end. Another bar is provided, similar in form, except that it has, instead of a blade, a curved arm made in a separate piece. The upper ends of the parallel bars are bolted to each other, and are kept at the proper distance apart by a washer. The lower parts of the bars are bolted to each other and are kept at the proper distance apart by the end of a curved arm. The bars are bolted to each other at the base of the stationary blade, which bolt also secures the curved arm to the bars and pivots the movable blade to and between said bars. The latter blade is formed upon the end of the bar, which is curved, and to its lower end is attached the upper end of the handle, the curvature of the bar bringing the handles into such a relative position that they can be conveniently operated even when made long. The curved arm passes through a keeper attached to the side of the bar, and assists in giving firmness and steadiness to the shears when in operation. To the side of the curved bar is attached a stop, in such a position as to prevent the edges of the blades from coming in contact with and being dulled by the frame work of the shears.

Improved Coiled Wire Brush.

John B. Christoffel, Williamsburg, N. Y.—This invention has for its object to furnish an improved wire brush, the brush of which shall be formed of coiled wire, and which shall be flexible, so that it may be readily used in different sized tubes. The invention consists in an improved coiled wire brush, formed by the combination of one or more coiled wires with two or more twisted wires. This construction makes the brush very flexible, the coils of the coiled wires inclining freely in either direction, and their outer sides, pressing against the surface of the tube, clean it quickly and effectively.

Improved Binding for Sewing Machine Covers.

Evelyn F. French, New York city.—The object of this invention is to prevent the breaking or parting at the corners or other places of sewing machine covers, or similar boxes which are exposed to strain and liable to be broken unless strongly protected; and it consists in making the lower molding which embraces the sewing machine cover, or any one or more of the moldings embracing the same, of narrow veneers, which are glued together, and in forming the combined veneer molding thus made in one single length, and placing it around the cover or box, thus preventing the necessity of interposing additional fastenings or of specially jointing the pieces at the corners where such boxes are most apt to become injured.

Improved Spring Bed Bottom.

Elon G. Sherman, Forestville, N. Y.—This invention has for its object to improve the construction of the spring bed bottom for which letters patent No. 103,425 were issued to Daniel C. Brownsen, May 24, 1870. To the under side of the end parts of the upper or arched springs are attached sockets to receive the ends of the lower shorter springs. The middle parts of the side springs are secured to bars which are made so that their ends may rest upon cleats attached to the end rails of a bedstead. The bars are connected by cross bars, which not only hold the side springs in their proper relative positions, but also receive and support the ends of the upper springs, should they be subjected to a heavy weight. The middle parts of the intermediate lower springs are secured to longitudinal bars. Cross bars, the inner sides of which are beveled off, connect the intermediate sections of the bed bottom with the side sections, and hold them in their proper relative position, and at the same time strengthen the springs. Coiled wire springs are secured to the side springs, upon the upper ends of which rest the upper springs, pieces of cloth being interposed between the springs to deaden the sound.

Improved Corn Crib.

Joseph M. Hughes and Andrew J. Mapes, Independence, Mo.—The object of this invention is to provide means for allowing the corn in the crib to be self discharging into a trough or troughs for the feeding of stock. The corn crib has a floor which inclines from the ridge in opposite directions. This ridge runs lengthwise of the crib, and the inclination is sufficient to allow the ears of corn to slide down by their own gravity into the troughs. Troughs are placed on the sides of the crib so as to receive the ends of the bottom boards. Adjustable feed bars are arranged by means of which the quantity of corn discharged is regulated. These bars slide in angular grooves in the corner posts of the crib, and may be adjusted so that more or less corn will slide into the troughs.

Improved Lubricator for Steam Engine.

William R. Patterson, Chicago, Ill.—This invention consists of a sheet metal oil tank, capable of sustaining the pressure of the boiler applied to the steam pipe, and having a connection with it, above and below, with cocks to allow the steam to pass through it and shut it off at pleasure. There is a filling cock at the top, a feed cock at the bottom, and a glass gage and waste cocks for letting off the steam pressure and condensed steam, all arranged in such manner that, the steam being admitted to the oil in the tank and the feed cock opened at the bottom, the oil will flow into the steam pipe with the current of steam when the engine is running, and be conducted along with the steam into the engine, but will be prevented from escaping through the feed cock when the engine stops, because the pressure on the oil is then equal below to that above. The small passage in the feed cock through which the oil passes will be sufficiently obstructed thereby to prevent the oil from descending by gravitation.

Improved Scrubber.

Israel J. Emory, Jr., Webster, O.—This invention relates to a new scrubber in which plates of rubber cut into narrow strips are employed to furnish the requisite rubbing surfaces. These strips are fastened to the head block by means of metal plates, and furnish excellent rubbing surfaces that will yield to all inequalities of the floor or articles to be scrubbed, and can be used on carpets, oil cloths, etc., without injury thereto.

Improved Lumber Measure.

Frank S. Baldwin, St. Louis, Mo.—The invention consists in the improvement of lumber measures. A small circular sheet metal case is made with a reel inside of it on the axis, with a tape measure coiled on its face. A coiled spring is arranged upon one side for winding up the tape measure, and a disk on the other side for transmitting its motion to recording dials, when the tape is pulled out and stretched along the piece to be measured. This disk has ratchet teeth in the periphery, and is engaged by a spring pawl on the whirl, which runs back on the disk when the spring winds up the tape, and engages and turns it when the tape is pulled out. A cone of differential gears is attached to this disk for transmitting the motion to the recording d'als, of which there are four sets. These differential wheels are graduated to actuate the recording train correctly for several different lengths of lumber—say the smallest one will be of the right size for turning the recording dials so as to indicate correctly the measure of lumber of ten feet in length, the next one similarly for twelve feet lumber, and so on. It is only necessary to turn a thumb piece, and shift it in a slot properly for engaging any particular slot with the pin for changing the connection of the train of recording disks, to set the machine for the length of the lumber to be measured. The transmitting gears may be changed from one recording train to another; and suitable mechanism is provided in order to prevent the trains from being disturbed or changed when this shifting takes place.

Improved Portable Stock Feeder.

Joseph M. Spencer, La Plata, Mo.—The object of this invention is to supply a combined corn crib, hay rack, trough, and hog pen, constructed in a cheap manner, capable of feeding stock economically and of being easily taken to pieces and removed from one farm or part of a farm to another. The invention consists of a roofed corn crib with the hog pen in the lower part. At convenient hight is placed the feeding trough extending around the crib and admitting a large number of animals to feed at the same time. Above the trough, bolted to the crib and also extending around it, is the hay rack, of the same hight as and corresponding in shape to that of the corn crib. The whole structure may be constructed either entirely of wood, or of wood and iron or other material, and may, by placing it on scantlings, be easily transported.

Improved Machine for Gumming Saws.

Karl Weinberger, Milwaukee, Wis.—This invention is an improvement in saw gummers of the class in which an emery wheel is mounted on an arbor having its bearings in a pivoted frame, oscillating in a vertical plane to carry said wheel alternately into and out of engagement with the teeth of the saw, which is arranged horizontally, and secured to its support by suitable means or devices. The improvement relates specifically to a curved stationary arm and sliding adjustable stops thereon for limiting the throw or movement of the vibrating frame.

Improved Automatic Fan.

Philip H. Reichhardt and Morriss Schnapp, Brunswick, Mo.—The inventors employ a chronometer mechanism for driving one or more swinging fans for generating air currents, driving away insects and the like in warm weather, using a pendulum instead of the hair spring for regulating the motion, and attaching a swinging arm to the shaft, which works the pendulum for obtaining the vibratory motion for the fans.

Improved Dress Facing.

William H. Gallup, Troy, N. Y.—This invention consists of a new article of trimming for facing, stiffening, and protecting the bottoms of the skirts of ladies' dresses, which is composed of a strip of starched, gummed, or otherwise stiffened muslin of the character of wigan, say four inches, more or less, wide, of the same or any equivalent material further stiffened by fluting sewed on one edge. It is made in twelve yard pieces, and put up for market in the ordinary way of putting up goods of this class.

Improved Medical Compound or Liniment.

Joseph Benda, Yatton, Iowa.—The object of this invention is to furnish an improved liniment for internal and external diseases, such as rheumatism, colic, diarrhœa, headache, etc., to be used either by rubbing the parts lightly with it or by mixing it with water. The liniment consists of oil of sassafras, oil of hemlock, spirits of turpentine, tincture of Cayenne pepper, tincture of catechu, guaiac, tincture of opium, tincture of myrrh, oil of origanum, wintergreen, gum camphor, chloroform, and oil of cedar. This compound is dissolved in alcohol, forming a light reddish liquid.

Improved Medical Compound for Treating Rheumatism, etc.

Gideon Lucy, Mobile, Ala.—This invention consists in a compound to be used as a medicine for the cure of rheumatism, neuralgia, and similar nervous diseases, and for benefitting the human system generally. The medicine in one form is composed of a tincture or extract containing the root of the lint plant, combined with diluted alcohol. The root of this plant may be macerated or reduced to a pulp, or be concentrated by boiling, and combined with any other material to form a sirup or for making pills for medicinal purposes.

Improved Lubricator.

William Morris, Dayton, Ohio.—This invention consists of a hollow stop cock in the passage from the oil chamber to the steam chest, into which a quantity of oil is received when the cock is turned so as to shut the passage to the steam chest or pipe and open the passage from the oil chamber. The oil is discharged by steam pressure when the cock is turned to open the passage to the steam chest, and shut the passage to the oil chamber. The steam for expelling the oil from the cock is admitted to it by a small pipe connecting it with the steam pipe so that a current will pass through the cock and back into the steam pipe or into the steam chest, according to which the lubricator is attached, and carry the oil in the hollow plug along with it.

Improved Balanced Slide Valve.

Abraham O. Frick, Waynesboro, Pa.—This invention is an improvement in the class of hollow slide valves provided with flexible diaphragms or packing rings; and it consists in the arrangement of a flexible corrugated ring in connection with a valve formed of two parts, one sliding vertically within the other. This mode of packing the two cylinders affords an absolutely steam tight joint, with little or no friction, and is alike applicable to cylinders or square or other shaped forms which it may sometimes be desirable to substitute for them.

Improved Doublet Stone.

Simon Bruhl, New York city.—The object of this invention is to furnish a doublet stone which not only avoids some of the disadvantages of the former doublets, consisting in a lack of brilliancy and an easy injuring of the edges, but combines advantages which have hitherto not been produced and by which the application of "doublets" to jewelry can be greatly extended, the brilliancy and transparency of the stones increased, and such jewelry manufactured at cheaper rates. This object is accomplished by adding to the form of doublet stones now in use one or more steps or rows of facets to the upper part or "front" of the stones, and by making the uppermost part or step only of genuine stone, and the rest of paste.

Notes & Queries

L. asks for directions for staining pine wood in imitation of mahogany.

D. B. asks for the best mode of making spiral springs 5 inches long, from No. 8 steel wire; also for the best mode of tempering them?

J. J. G. says: Seeing an answer in the *Scientific American* regarding a standing point in the circumference of a wagon wheel in motion, I would like to know (1) if the center of a shaft revolving is also a standing point; and (2) what part of the wagon wheel is the fulcrum, and if the spokes of a wagon wheel are levers?

W. F. R. says: I was surprised to read the following in your journal for May 17: "Newton's explanation of the movements of the solar system is probably correct in theory, but it is deficient in one important particular: it fails to account for the motive power. The attraction of gravitation we all understand; but what is the counteracting force? An original impulse will not answer, for a transient force cannot successfully contend with a constant force of anything like equal intensity." It seems to me that a theory which fails to account for the essential condition in a problem must be ruled out as a theory. Your correspondent suggests magnetic attraction as affording the best solution of the problem of the movements of the heavenly bodies. His theory, if I understand this writer, equally fails in satisfying an essential condition of the problem: "An equatorial current of magnetism," he writes, "sweeping round the sun from west to east in the plane of the ecliptic, with immense velocity, would account for the motion of the planets in their orbits, and of the sun on its axis." What gave the original impulse to such equatorial current? and how is its velocity maintained?

W. S. B. asks: What is the best *modus operandi* for recovering diamonds from the *debris* of a fire, the settings having been melted and run into nuggets? The plan I pursued was first to run the *debris* through suitable screens, first through a coarse one to get out the large stuff, and then through a fine one to get out the dust; I then use a large tub of water and wash the *debris* in a fine sieve about a foot in diameter. After shaking a little in the water, I sink the sieve and float off the burnt wood or any other matter that will float; leaving the balance, in the shape of gravel and pieces of plaster, perfectly clean. I have no trouble in finding the smallest pieces of gold, as that metal will lay solid in the bottom of the sieve when held at an angle and shaken in the water; the balance rolls to the lowest part of the sieve. I have found some garnets with half the setting burnt off and the stones unaffected at all. Some people say that diamonds turn black by being in fire, and Fowne's *Elementary Chemistry* says that the diamond is infusible and unalterable by a very intense heat, provided air be excluded. If they are unalterable, can they turn black?

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There is no form of protection that is more easily obtained, or which gives better satisfaction so far as it extends than the copyright, and the simplicity and excellent practical working of the law ought to afford useful instruction to those who constantly aim to add complexity to our mechanical patent laws.

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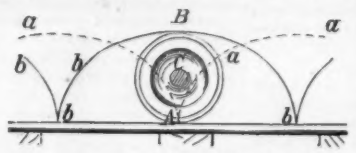
H. C. T. will find the process of tinning cast iron described on pp. 212, vol. 26, and 123, vol. 28.—R. B. P. will find the laying off of carriage wheels and axles discussed at length on p. 189, vol. 28.—E. McG. will find a rule for proportioning screw cutting gear wheels on p. 154, vol. 25.—H. C. L. should refer to p. 75 of our current volume for a recipe for paste that will adhere to bright tin.

P. says: In your issue of May 3, M. H. B. asks this question: Does the top of a drive wheel on a locomotive turn or run faster than the bottom when it is running on the rail? You answer: Yes. Will you be kind enough to explain why? Answer: Every point in the wheel describes a curve called the cycloid, roughly represented here, A, a, a, B, b, b Each point in the



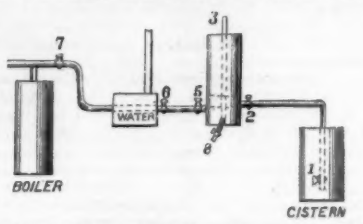
wheel, when in contact with the rail, as at A, must, unless the wheel slips, be at rest. Each point when farthest from the rail, as at B, moves with double the speed of the center C, which has the regular velocity of the locomotive.

C. B. O. asks how to dissolve mercury from gold coin, which had been put into mercury for experimental purposes. Answer: The mercury can be volatilized and expelled by heating the coin sufficiently.

E. S. says: I have three boilers in my charge, two Cornish and one return flue. The Cornish are 24 years old, and are to be taken out this summer and others put in their places. I would like to know what kind of boiler you would recommend, leaving the sectional boilers out of the question. I would prefer the Cornish to the return flue. How does the return tubular boiler compare with the Cornish on the points of steaming, safety, economy, attention, and expense? Can the Cornish be surpassed in any of these particulars? Answer: The choice of a boiler is determined by special circumstances, which vary in each individual case. With cheap fuel and cheap labor, the plain cylindrical boilers may be used. If the water is very bad, the cylinder or a flue boiler must be used, as it can be more readily cleaned than tubular boilers. The Cornish boiler is an excellent boiler where slow draft and moderate pressures are allowable. For high steam and quick draft it is not suitable. With clean water, high steam, a good draft, and with fuel at a high price, we should advise tubular boilers, as better than any of the other standard styles. We cannot say what style would suit the case here given but were we told something of the nature of fuel and attendance, we could readily say what we would do.

O. S. asks: Can you tell me why the air is warmer in a icehouse on top of ice than it is outside in the shade? I have a frame ice house, with two feet air chamber all around, and walls lined with saw dust 6 inches thick on each side. It is 30 feet high, with 6 foot loft; there are two 6x3 doors in loft, one in each end. The loft is tight, and I try to keep the house as near air tight as possible. I leave the loft doors open very often, so as to take off the heat that comes through the roof; the thermometer stands from 68° to 78° in the house on top of the ice. Is this warmer than it should be, and does the heat affect the ice beneath 12 or 18 inches of saw dust? Is it the best plan to keep the house closed, or let the air circulate over the ice? Answer: Cold air always remains as a lower stratum and warm air uppermost. Heat passes through the roof more readily than the cold is transmitted through the thick layer of sawdust, and the air is thus warmed above the latter as air is warmer in any garret or attic when the sun's rays fall on the roof. The cooler the air is kept, the less the loss of ice, but we presume that the sawdust is an effective protection.

R. L. L. asks: Can you explain the trouble with my pump? It is a combined lifting and supply pump; the plunger (No. 3) is solid 3 inch iron, which moves up and down in the pump stock, packed with hemp or cotton packing. I lift water 22 feet. Nos. 5, 6 and 7 are check valves to keep back the water in the boiler. My pump has failed to lift, although it has more than sufficient capacity: and I have frequently had to open the air cock (No. 8) to stop the action of the pump. Today my pump failed entirely, and when I took off the cap of valve (No. 2) I found the valve stem so tight that I had to use force to extricate it; and when I removed it, the air rushed in with a great noise. I put on a valve (No. 1) some time ago at bottom of pipe in cistern to hold up the column of water, thinking the lift was too great. Sometimes it throws for a few strokes, ceases



for a time and then commences again, and so on. I can find no leak between the pump and the cistern. Answer: Take out valve on suction side, turn off a sixteenth of an inch from its stem, or bore out its guide the same amount, or cut a spline either on stem or inside guide, to let air past it; repack plunger; see that check valves on the other side are all right. If trouble still occurs, the pump must be set lower. The lift is rather more than should be generally given. A plunger pump can force to any ordinary hight or against any usual pressure, but no pump is likely to work well with such a lift after it gets a little worn.

E. P. asks: 1. What is hydrochlorate of aniline? 2. What is bichloride of copper? 3. What mordants are used for aniline colors? 4. Are aniline and carbolic acid the same? Answers: 1. Hydrochlorate of aniline is produced by the action of hydrochloric acid on aniline oil, and crystallizes in needles which may be sublimed without decomposition. 2. Bichloride of copper is prepared by dissolving the oxide of copper in hydrochloric acid, and forms green needle-shaped crystals. 3. Albumen is usually used for mordanting cotton; silk and wool require no mordants to take the aniline colors. 4. Aniline is entirely different from carbolic acid in composition, odor and properties, although dyes may be prepared from both. The former has the chemical composition represented by the formula C_6H_7N or $C_6H_5(NH_2)$ and hence is sometimes styled phenylamin. Carbolic acid has the composition C_6H_6O or $C_6H_5(HO)$, called also hydrate of phenyl.

R. H. A. says: A difference of opinion exists as to the location of the point delivering the average power from a lever or wheel, the pressure and the speed being the elements. Assume a hydrostatic or steam pressure against a surface represented by a lever: clearly the average would be in the center of space. Then if motion were given from the fulcrum, the speed necessarily increasing towards the free end, the same pressure, continuing, would seem to relocate the point of power. What do you say? Answer: At the middle point, if we see the point of the problem.

L. H. & Co., say: We are manufacturing car wheels and axles for coal mines in our vicinity. For the wheels, we select the closest iron, mostly scrap; in fact, we make them as hard as we can, and bore them. We bore the wheels to a gage and turn the axles to fit, so that there is no more play than is necessary for the wheel to work freely. Some of our customers think that the wheels and axles are not as durable as they should be, but that if the axles were forged and not turned, they would last much longer. One firm tried this and complain that, because a wheel working on such an axle lasts but one year (constant use night and day) that the wheels are made of poor iron for the business, and that the whole fault lies in the wheel; and they will not be convinced, that a turned axle would be better, without referring to you. Do you think that a chilled hole is preferable to a drilled one in such wheels? And is there any iron better for these wheels (unless it is Salisbury or other regular car wheel iron) than close hard scrap? Answer: The best wheels are made of selected new iron. Scrap may make good, bad, or indifferent wheels, according to its original quality. Mixed scrap is likely to give a very close grained iron, and, if it chills well, will probably make a durable wheel. A wheel should run 45,000 or 50,000 miles before giving way. We should suppose that the wheel referred to was of excellent quality if it kept at work night and day for a year. The average life of a wheel under ordinary circumstances is three years. We presume that the actual running time is not a fifth, perhaps not an eighth, of this. We should not chill the hole, but should drill it.

I. B. asks: In vertical tubular boilers, what is the proper proportion of grate surface for square foot of heating surface; and what is the proper area of tube per square foot of heating surface and grate surface? What are similar figures for double return tubular, portable or fire box boilers? What difference is there between bituminous and anthracite coals? Answer: The greater the proportion of heating to grate surface, the more economical is the boiler, usually. The best proportion, all things considered, for a tubular boiler, is not far from 30 feet of heating surface to the square foot of grate. Make the cross area through tubes about one eighth the grate surface. Bituminous coal contains gaseous and bituminous constituents, while anthracite is nearly pure carbon and earthy matter. A rich bituminous coal contains 60 or 70 per cent carbon, 10 or 15 per cent gas, and the remainder is ash. Good anthracite contains 90 per cent carbon, and 10 per cent ash.

H. H. J. says: Will you please tell me how the water is elevated by the engine at the Ridgewood waterworks? Is it by a chain pump, water snail, or other means? What is the common method of elevating water? Will a pump of large dimensions work? All the pumps that I have seen were common well pumps having about 3 inches bore. Would a pump of 12 or 15 inches bore work just as well? Answer: Pumps are almost invariably used for raising water. In supplying towns they are invariably used. As a rule, the larger the pump, the more perfect its operation.

H. B. says: I have some gold and silver solutions, which have been mixed through mistake; how can I separate them? Answer: Take a solution of common salt and add it drop by drop as long as any white precipitate falls. Filter off this precipitate, which is chlorate of silver, and the gold will remain in the solution. To get the silver out of the precipitate, dry it and fuse it with an equal weight of carbonate of soda mixed with one tenth its weight of saltpeter.

J. T. asks: What is the exact amount each of common burning gas and air requisite to make an explosion, when ignited, and what would be the force of such an explosion per cubic inch? Answer: Ten volumes of air and one of gas will explode when ignited, and exert a pressure of 210 lbs. to the square inch. Two volumes of pure oxygen and one of marsh gas will explode and produce a pressure of 555 lbs. to the square inch.

A. S. T. says: 1. Please tell me the composition of the clay of which sculptors make their models. If it is not clay, what is it? 2. Did the sewing machine companies get Congress to extend their patent? Answer: Sculptor's clay is composed of silicate of alumina chiefly. Almost any fine clay becomes plastic when moist, and the model must be kept wet until completed, when a plaster cast is made from it. Perhaps it is the plaster cast that A. S. T. refers to, for it is according to this model that the marble is cut, as the clay model cannot be preserved long. 2. The sewing machine patent has not been extended by Congress.

J. R. asks what is the best method of waterproofing canvas to be used in building a light boat? Should it be applied before or after stretching the cloth? Answer: For waterproofing canvas for tents H. Kuhr passes the material through sulphate of alumina (1 part concentrated alum cake in 10 of water) then through resinous soap and water, afterwards drying and smoothing it. The soap bath is kept hot. See also SCIENTIFIC AMERICAN, pp. 122 and 170, vol. 25. For waterproofing a boat, linseed oil is boiled until viscid (for 4 or 5 hours) then burned 5 minutes, and either applied hot, or, if allowed to cool, is dissolved in benzine. This is, of course, applied after stretching.

W. R. K. asks how many cubic feet of pure hydrogen gas are required to raise 75 lbs. weight? How many cubic feet of common illuminating gas are required to raise the same weight? Answer: Since 100 cubic inches of hydrogen weigh 2·14 grains and air weighs 14·4 times as much, or 3·08 grains, 100 cubic inches of hydrogen will support or float about 28·6 grains. From these data, it will require, theoretically, about 1,000 cubic feet to sustain a weight of 75 lbs. Illuminating gas varies in specific gravity from 0·65 to 0·34; and hence, from 15,000 to near 30,000 feet are required to do the work of 1,000 cubic feet of hydrogen; nevertheless, street gas is generally considered to be the cheapest of the two.

B. says: I read in the SCIENTIFIC AMERICAN that india rubber varnish could be made by dissolving the rubber in bisulphide of carbon or sulphuric ether. I procured some sulphuric ether and put some rubber in it; it has been there several weeks, and looks just as it did when put in. Answer: Perhaps you did not employ crude unvulcanized caoutchouc, and hence its apparent insolubility.

A. says: In your paper of March 1, 1873, you notice two cases of spontaneous combustion in piles of coal. Is there any danger in piling 8 or 10 tuns of coal in a cellar, in July or August, there to remain for the coming winter's use? The difference in the price of coal between summer and winter is an item worth saving; but if there is danger, we had better pay the winter price. Answer: No danger. Put in your coal. You need not fear spontaneous combustion in a coal heap if no organic substances or pyrites is present in the coal bin; there is more to fear from rags used in cleaning lamps and rubbing up your sewing machine.

S. asks for a recipe for making a solution to take the ink out of paper without injury to the paper. Answer: Employ dilute oxalic acid or some Labarraque's solution.

F. P. C. asks for the most approved and simplest way of testing adulterated mixtures of white lead, so as to tell the per cent of zinc and sulphate of baryta. Answer: White lead when pure is perfectly soluble in dilute nitric acid. If sulphate of barium is resent, it remains undissolved in nitric acid, and may e filtered out, washed, ignited and weighed. Sulphate of lead and gypsum, are also nearly insoluble in nitric acid. The lead can also be determined in the nitric acid solution by precipitating with dilute sulphuric acid, filtering, washing, drying and weighing: 1,000 parts of sulphate of lead correspond to 736 parts oxide of lead (PbO) or 861 parts of pure carbonate of lead. Or, we may say that 3,345 parts of PbO correspond to 3,875 parts of pure white lead, as represented by the formula $2(PbO, CO^2)+PbO, HO$.

H. M. L. J. says: To test gold, I use muriatic acid, but I am often fooled with heavily plated brass. Do you know of anything that will detect brass or any low metal under a heavy coat of gold? Answer: In buying gold rings, etc., which have no settings, the specific gravity will serve to distinguish brass, no matter how heavily plated, from gold. Suspend the ring by a horse hair from the end of your balance and weigh it; hen arrange a glass of water in such a manner that the ing will hang in it without touching the sides or bottom and weigh again. Divide the weight in air by the loss of weight in water. Thus, if a piece of jewelry weigh 193 grains in air and 183 grains in water, 10 grains will be the loss of weight in water, and we have for its specific gravity 193÷10=19·3, which is the specific gravity of pure gold. If, however, it were pure silver, we should have 193−173=20, and 193÷20=9·6. For copper we have about 9, and for zinc only 7.

E. H. G. says: I have a small cylinder engine, 1¼x3 inch stroke. How large a boiler will it take? Had I better have it of copper or iron? How many pounds of steam ought it to take to run it? Answer: See reply to T. P. B. on page 283 of our current volume.

M. J. F. asks: How is sodium amalgam prepared? Answer: Rub together 30 parts, by weight, of dry metallic mercury and 1 part metallic sodium. The mercury is placed in a mortar and the sodium added in pieces not larger than a pea. The reaction is so violent that the hands and face should be protected by covering the mortar with a piece of pasteboard, through which the handle of the pestle projects.

J. L. P. says: I took some roll sulphur and placed it in a small glass retort, to make sulphurous gas. The small glass tubing, connecting the retort with the receiver, became choked up with thick sulphur in such quantity that the tubing could not be used. It appeared as if the vapors of the sulphur condensed in the tubes, thereby rendering them useless. After the operation, I could not remove the sulphur from the retort, as it adhered firmly to the sides and bottom to such an extent that I broke the retort in endeavoring to remove it. Can you give me a remedy? Answer: To make sulphurous acid gas, you should take copper turnings and sulphuric acid, and apply heat to the retort. You simply distilled the sulphur. You can remove such a deposit by heating.

S. A. B. asks: Will a horseshoe magnet, if perfectly magnetized, retain its power if the keeper does not touch it, but revolves very rapidly as closely to the magnet as possible without friction? Answer: We believe that an artificial steel or cast iron magnet under these circumstances would gradually lose its power. Professor Plympton, of the Cooper Institute, New York city, has had a large steel magnet induction machine for a long time; and no doubt will give you a positive answer to the question of diminution.

J. J. P. says: I have lately built a telegraph line along a distance of about 300 yards, the conductor of which is a large iron wire, well insulated with glass, and having copper wires soldered to the ends to insure good connections. The ground wires are treated in the same manner, with plates of clean copper soldered to their ends and buried in moist earth down in a cellar, at a depth of about two feet. The instruments used as sounders are of my own manufacture; the magnets only contain about twenty feet of wire, and consequently are not very sensitive to a small quantity of electricity. I find, on applying two cells of Daniell's battery and limiting the circuit to one instrument and the battery to short wires of three or four yards length, that they work with great nicety, but, on turning the same current to the long conductor and ground wires, that no visible force is produced. On adding two more cells (four in all) a slight ticking is produced on the sounders when the circuit is broken and closed. The wires are all of good size, and there seems to me to be no chance for any great amount of resistance. I have tried connecting all the zincs, also connecting in the usual manner; but find the former to be the only way in which anything is effected. I wish to know the cause of the force being so greatly reduced in so short a distance. Answer: Your copper plates have not enough surface; make them larger and place them in the nearest pond or brook. A better way is to connect the ground wire, at both offices, with the gas or water pipe.

W. S. M. and others have asked us for an explanation of the wire gage used in describing the diameters of wires and the thickness of metal plates. The letters B. W. G. stand for "Birmingham wire gage," and the dimensions of the various marks are as follows, the sizes being in fractions of an inch:

Mark.	Size.	Mark.	Size.	Mark.	Size.	Mark.	Size.
0000	·454	7	·180	17	·058	27	·016
000	·425	8	·165	18	·049	28	·014
00	·380	9	·148	19	·042	29	·013
0	·340	10	·134	20	·035	30	·012
1	·300	11	·120	21	·032	31	·010
2	·284	12	·109	22	·028	32	·009
3	·259	13	·095	23	·025	33	·008
4	·238	14	·083	24	·022	34	·007
5	·220	15	·072	25	·020	35	·005
6	·203	16	·065	26	·018	36	·004

L. L. asks: How can I restore the silvering to a mirror which has had the coating knocked off in a spot larger than a pea? Answer: Put on a square foot of tin foil about 3 drams of quicksilver, and rub in with a piece of buckskin until the foil becomes brilliant. Lay the glass on a flat table, face downwards; place the foil upon the damaged portion of the glass; lay a sheet of paper over the foil and place on it a piece of marble or other weight with a perfectly flat surface and sufficiently heavy to keep it down tight; let it remain in this position a few hours. The foil will adhere to the glass.

J. L. D. can charge wine with carbonic acid by placing it in strong metallic vessels, and forcing the carbonic acid made from chalk and hydrochloric acid into it under great pressure.

C. E. W. asks how percussion or fulminate powder is prepared. Answer: We give the following method, although we do not advise persons unfamiliar with chemical operations to meddle with the preparation of so dangerous a substance: One pint of mercury is dissolved in 12 pints of nitric acid of specific gravity 1·3; when cold, it is mixed with 11 pints of alcohol of 85 to 88 per cent, and the mixture heated in a water bath until it begins to show turbidity. Let it cool, pour off the liquid and collect the powder on a filter. It can be purified by dissolving in boiling water and recrystallizing it. It explodes at 356° Fahr., or when struck; and is highly dangerous to handle when dry.

F. P. B. asks: Why is the armature of an electro-magnet attracted by the ends of the cores and at no other place? Why is the magnetic force greatest at the ends of the cores? Answer: Magnetism of one kind attracts the opposite kind. A piece of soft iron becomes magnetic by induction. In the center of the bar, it is repelled as much by the magnetism in one half of the bar as it is attracted by that in the other, and hence seems to be unacted upon by the magnet. As we approach the end the sum of the attractive forces is greater than that of the repellant, and just at the end there is no repellant power to counteract the attractive force, so that, as Ganot says (page 538), the polarity at each end of a magnet is caused by the fact that the resultant action on a body is strongest at the end, and does not follow from an accumulation of the magnetic fluid at the ends. (See also Silliman's "Physics" p. 547.)

F. E. B. is making a tent of unbleached sheeting, and wants to know what will make it waterproof without rotting it. Answer: Coat it with india rubber varnish, or a solution of paraffin in benzine, or try a solution of gelatin mixed with a trifle of bichromate of potash. The latter will darken on exposure to the light, the gelatin becoming insoluble and impervious to water.

H. P. C. says, in reply to E. W. W.'s query as to the length of an arc where chord and versed sine are given: A simple rule is the following: From 8 times the chord of half the arc, subtract the chord of the whole arc, and one third of the remainder is the length of the arc. I do not think there is a simpler or shorter formula than this. Let A B C be the arc, A C the chord, B D, a perpendicular bisecting both the arc and the chord. Then, 8AB−AC÷3=arc. [E. W. W. has answered this query to the same effect.]

J. S. R. replies to H. P. L., who asked what is the best material for laying up the arch for a steam boiler; Use fire brick and fire clay for the inside course; but in case they cannot be had or are considered too expensive, use the following for the course next the fire: a fair red brick, burnt neither too hard nor too soft, but of a light cherry red. For mortar, get a good yellow clay, 8 parts, wood ashes, unleached, 6 parts, common coarse salt (any refuse salt will do), 6 parts. Mix well with a hoe and see that no lumps remain in the clay, adding water until the proper consistency is acquired.

J. E. H. says, in reference to E. C. M.'s problem: The result obtained by G. A. H. is not correct. He says "0·757×32=25·224." This is not true. It should be 0·757×32=24·224. His results would then agree with the answer I sent. His formula "½[(P−Q)sin. a]÷(P+Q)×gt²" is also incorrect. It should be: ½(P−Q. sin. a)gt²÷(P+Q).

F. H. C. says that, if F. H. B. and others who want to turn off solid emery wheels, will place a tin pan with some hot water just under the wheels, so as to keep the faces of them wet, they will find that it will be very easy for them to turn them off with a piece of ⅜ square steel. Let the wheels stand three or four hours after, to get dry.

L. A. G. says P. F. B., who asked how to restore old files: First remove all grease or oil by boiling for half an hour in a strong solution of rain water and saleratus, after which wash and dry well. Then take water, ½ gallon, sulphuric acid 8 ozs.; mix in an earthen or glass jar. Coarse files require 10 or 12 hours to recut, while fine ones require but 5 or 6. Put in the coarse ones first, and the fine ones a few hours afterwards, that all may be taken out at once; sponge them off in boiling water, that they may dry quickly, and apply sweet oil to prevent rust. Files that have been used in the softer metals need not be kept in the cutting solution more than 3 or 4 hours, and may be recut two or even three times.

W. S. H. says, in reply to H. S.'s query on a leaky piston: It would not cause bumping, but would show in the exhaust. If the slide valve were loose, it would give visible evidence at once by stopping the engine. If only slightly deranged, it might not stop the engine, but would cause it to run very irregularly. In either case it would be seen that something was wrong.

L. N. L. says, in reply to W. W. C., who asked: "Is there anything that will make leather stick to iron?" In an old scrap book I find the following formula for making a cement that is said to adhere with the greatest tenacity to wood, stone, glass, porcelain, ivory, leather, paper, hair, etc. Melt together, in an iron vessel, 2 parts, by weight, of common pitch, with 1 part of gutta percha. It is said to form a homogeneous fluid, which is much more manageable for many useful purposes than gutta percha alone, and which, after being poured into cold water, may be easily wiped dry and kept for use.

S. A. T. replies to F. S., who asked how to make marking ink for marking boxes, etc.: Take 1 lb. extract logwood, dissolve in 1 gallon hot water; add 1 oz. bichromate potash. It is immediately ready for use.

S. A. T. says: I do not think the recipe of C. M. D. in reply to F. S. T., for making a black board on the wall will do; in fact I know it will not for wood, as the varnish, as a matter of course, leaves a glazed surface caused by the evaporation of the spirits from the shellac, and chalk will not mark perfectly on that any more than on

L. says that F., who asked if he could use three of Hooke's universal joints of 11° each to get an angle of 33°, can solve his difficulty by raising one of his shafts above the other, maintaining a parallel horizontal plane, and, with suitable grooved pulleys and a steel wire rope, transmit his power from one shaft to the other. Or, if the condition be such that the shafts cannot thus be accommodated, let him introduce a third shaft, either above or below the others, and on a plane precisely parallel with them, so adjusted in its bearings as to divide this vertical divergence, and then with grooved pulleys and steel wire rope transmit his power through the applied shaft. At the Industrial Exposition at Cincinnati, in October, 1871, 100 horse power was transmitted from one shaft to another, at a distance of some 150 feet apart, by means of a steel wire rope not exceeding one inch in diameter.

S. A. T. says, in reply to several correspondents who ask how to temper drills, chisels, taps, dies, etc.: The following process will make a drill bit sufficiently hard to rapidly drill through gray cast iron, porcelain, glass, etc.: Melt in an iron ladle, with a little rosin, 5 parts bismuth, 3 parts lead, 2 parts tin. Place the instrument to be hardened in an iron tube welded or capped at the lower end; pour in the above alloy, leaving sufficient room, between the surface of the same and a stopper or cap at the upper end, to allow for the dilatation of the contents; then bring the pipe to a bright red heat and plunge into cold water. Immediately take off the cap or stopper and reverse the tube in boiling water, when the contents will fall out and the operation is complete. When using the drill, keep it moist with turpentine and it will cut glass without losing its edge for a considerable length of time.

E. D. P. says, in answer to E. W. H.: The path described by the body, A B, when acted upon by the force, P, at or near the extremity would be represented by a straight line, perpendicular to the length of A B. In the earth's atmosphere, its path would be curved, as any one may find out by striking a falling stick at or near the extremity. Now the reasons of this curved path are as follows: First, the atmosphere acts upon the bottom of the stick by friction, and thus becomes a sort of fulcrum. Second, the force acting upon A B is not, as would appear, the simple force P, but the resultant of the forces P, and that of gravity. Both these causes removed, as they would be under the conditions of the problem, the body A B takes for path the line perpendicular to its length. If the body be acted upon by the force in its center, its path would evidently be the perpendicular to its length. E. W. H. does not state whether the force, P, simply hits or pushes the body. If it hits it, the motion will be uniform; if it pushes it, the motion will be uniformly accelerated, traversing in the second second twice the distance traversed in the first.

A. sends us a correction of his statement of the boiler explosion at Sacramento, Cal., published on page 266 of our current volume: "I made further inquiries and found that the boiler was set the reverse way from what I stated. What lead me into the error was the fact that, instead of putting the fuel in at the fire box end of the boiler, they had taken the grate bars out, built a brick wall on each side, and put a large cast plate at the back end of the boiler, with a door in it, through which the fuel was put. The fact that the firing was done at the east end led me to suppose, as a matter of course, that that was the firebox end of the boiler." [W. B. C. has written to us to the same effect.]

MINERALS AND INSECTS.—Specimens have been received from the following correspondents, and examined with the results stated:

J. J. W.—The specimen contains the minute eggs and *larvæ of pseocerus pini*, a beetle usually infesting the currant and grape; but lately it has been discovered at the west on the apple tree, and has been very injurious to orchards in Wisconsin.

E. M. C.—The pebble is chalcedonic quartz, of no value in the arts, for, although it is hard enough to cut glass, it is too soft for a gem.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Effect of Electricity on Metals. By J. L. W.
On Death by Hanging. By E. H. R.
On Zinc in Ohio. By H. S. D.
On Rheumatism. By O.
On Tannate of Soda. By J. G. R.
On the Million Dollar Telescope. By L. V., by E. G. B., and by F. H. E.
On Barentz' Hut. By E. N. L.
On the Glacial Theory. By F. M. S.
On Horse Power. By W. A. J.
On the Moon. By E. G. B.
On the Rainbow. By L. S.
On the Sun's Heat. By E. B.
On the Aurora Borealis. By W. J. McG.
On Public Roads. By H. B. P.
On Boiler Explosions. By G. M.
On Magnetic Variation. By J. T. C.
On Life Saving Devices for Ships. By H. F. E.
On Creeping Rails. By S. P. McC.
On Arctic Mammoth Remains. By I. P.

Also enquiries from the following:
F. A. W.—W. C. McG.—H. B. G.—H. O'B.—J. E. M.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

May 6, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

25,005.—GOVERNOR VALVE.—B. Fitts. July 23.
25,015.—WOOD SAW FRAME.—J. Haynes. July 25.
25,017.—STEAM BOILER.—R. Hooper. July 23.
25,035.—POST MARKING STAMP.—M. P. Norton. July 23.
25,071.—RAILROAD CAR ROOF.—A. P. Winslow. July 23.
25,167.—ELECTRIC GAS LIGHTING.—A. Wilson. July 30.

EXTENSIONS GRANTED.

23,886.—CULTIVATOR.—M. Alden.
23,921.—HARVESTING MACHINE.—M. G. Hubbard.
23,924.—MAIL BAG.—T. J. Lamden.
23,950.—CLOCK DIAL.—S. E. Root.
23,970.—STOVE.—J. G. Widmann.
23,957.—LATHES FOR IRREGULAR FORMS.—C. & A. Spring.
23,983.—COOKING STOVE.—H. G. Leonard.

DISCLAIMER.

23,294.—MAIL BAG.—T. J. Lamden.

DESIGNS PATENTED.

6,625.—CARPET.—O. Heinigke, New York city.
6,626 & 6,627.—TYPE.—J. Herriet, New York city.
6,628.—CLOCK FRONT.—E. Ingraham, Bristol, Conn.
6,629 to 6,635.—CAPES.—M. Landenberger Jr., Phila., Pa.
6,636.—BREAD PLATE.—H. S. McKee, Pittsburgh, Pa.
6,637 & 6,638.—TRIMMINGS.—J. Phipps, Philadelphia, Pa.
6,639 & 6,640.—SOCKETS.—C. B. Rogers, Meriden, Conn.
6,641 to 6,643.—CAPES.—M. Landenberger, Jr., Phila., Pa.
6,644.—FOUNTAIN BASIN.—J. Moore *et al.*, Brooklyn, N.Y.
6,645 & 6,646.—HOT AIR REGISTERS.—E. A. Tuttle, Morristown, N. J.

TRADE MARKS REGISTERED.

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1,249.—WATCH OIL.—E. Kelley, New Bedford, Mass.
1,250.—CHEWING TOBACCO.—Walker & Co., Detroit, Mich.
1,251.—CANDLES.—G. Delano, New Bedford, Mass.
1,252.—MEDICINAL OIL.—E. F. Libby, Allegheny City, Pa.
1,253 to 1,256.—PLUG TOBACCOS—Liggett *et al.*, St. Louis, Mo.

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VALUE OF PATENTS
And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO OBTAIN *Patents*.

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

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Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

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Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

To Make an Application for a Patent

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

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Chapter II. VARIETIES OF STEEL.—Wootz—description of ore from which it is made; furnace and blast; manner of its manufacture; philosophy of the process. Damascus steel; value of scimitars; imitation of it by wrought-iron and lampblack; wrought and cast iron; alloys, alumina and steel; etching the veins.

Chapter III. GERMAN STEEL—NATURAL STEEL; what it is made of; steel ore; sparry ore; form of forge-fire for making steel. Blast; common bellows; cylinder blast; fan blast. Tilt or force-hammer; construction of; speed. Faces of hammer; anvil block. Pillars, or housings; moving power; cam-ring; shaft; Irregularities in speed; waste of power; weight of wheel and shaft; number of wipers. Making natural steel; first appearance of steel in the forge; effect of boiling on the iron; making steel of white or No. 2 pig-iron. Use of fluxes. Making of steel from No. 3 pig-iron. Requisites for making steel; Form and dimensions of hearth; quality of bottom stone. Practical manipulation; Form of a steel cake; forging of the steel. Expense of the process; German method of making steel; Making steel in a puddling furnace; Refining of steel. The refining fires; fuel.

Chapter IV. AMERICAN AND ENGLISH METHOD OF MAKING STEEL.—Blistered steel; amount of steel annually manufactured in England; construction of the converting furnace. Chests, or cementing boxes; charging of the boxes. Cement. Working of a converting furnace; Degree of cementation; trial rods; melting of iron in the box. Gain in weight; Tilting; Refining fires; blast; operation of welding common steel; shear-steel. Tilts; forms of hammers and tilt-houses; anvils and hammer-heads. Cast-steel. Making of crucibles in Sheffield; mould for that purpose; weight of a crucible; mode of drying. Cast-house; furnaces; fuel; time of melting; manipulation; flux; tongs; casting. The mould; quality of cast-steel; American steel.

Chapter V. GENERAL REMARKS ON MAKING STEEL—Wootz; German or natural steel; difficulty in making it. First element; ore which is qualified; crude iron for steel; leading principles in carrying on a blast-furnace for crude steel-iron. Blistered steel; spring-steel in Pittsburgh; saw-blades of Philadelphia. Good iron for conversion; trial by experiment; by chemical analysis. Making the iron for conversion; Cement; Dimensions and materials of the converting chests; varieties of slabs; management of the chest. A new box, how dried. Form of iron. Firing of the furnace; trial-bars; closing of the heat; size and form of the blisters. Tilting of steel; Cast-steel; making it directly from iron and lampblack; oxide of iron with cast-iron, or lampblack; melting of wrought-iron; alloys of iron. Alloys of steel; Selection of converted bars; Form of air furnaces; Melting pots; Flux; Tilting of steel.

Chapter VI. NATURE OF STEEL—Hardness; Fine cast-steel; shear-steel; spring-steel; German steel; effect of too high or too low heat. Refrigeration of steel; mediums; in mercury, in acidulated water, in solutions of salt, in oil and fat, in sand, cold metal, and air; manner in which it is performed. Tempering. Characteristics of steel; hardness and tenacity; color and lustre. Texture; Sound; Cohesion; Elasticity; Specific Gravity; Fusibility; Welding properties; Magnetic qualities.

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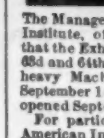

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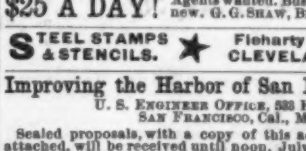

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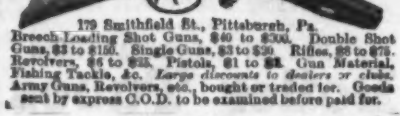

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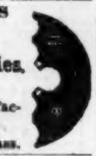

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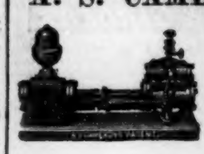

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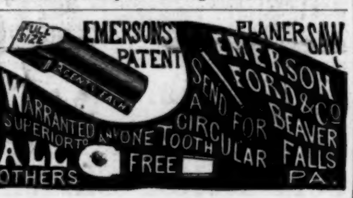

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